ANNEXURE TO INDENT NO:

REQUEST FOR PROPOSAL (RFP)
FOR
PROCUREMENT, MANUFACTURE, SUPPLY, ERECTION, TESTING & COMMISIONING OF WHEEL BOGIE SYSTEM FOR PIF

SPECIFICATIONS & PRICE SCHEDULE

OWNER : INDIAN SPACE RESEARCH ORGANISATION

PROJECT : PSLV INTEGRATION FACILITIES

LOCATION : SDSC, SHAR, SRIHARIKOTA

PSLV INTEGRATION FACILITIES (PIF)

SATISH DHAWAN SPACE CENTRE

SRIHARIKOTA -524124

INDIAN SPACE RESEARCH ORGANISATION

REQUEST FOR PROPOSAL FOR BOGIE SYSTEM SPECIFICATIONS & ANNEXURES			
SECTION	**SPECIFICATION NO:**	**ISSUE NO.**	**TITLE: REQUEST FOR PROPOSAL FOR WHEEL BOGIE SYSTEM**
SPECIFICATIONS			
A	PIF-BOGIE-01	R0	GENERAL TERMS AND CONDITIONS OF THE CONTRACT
B	PIF-BOGIE-01	R0	SCOPE OF WORK & TECHNICAL SPECIFICATION
C1	PIF-BOGIE-01	R0	BILL OF MATERIAL FOR BOGIE SYSTEM
C2	PIF-BOGIE-01	R0	HYDRAULIC JACK & POWER PACK SYSTEM
C3	PIF-BOGIE-01	R0	PAINTING SPECIFICATION FOR BOGIE SYSTEM
C4	PIF-BOGIE-01	R0	SPECIFICATIONS OF ELECTRICAL SYSTEMS
D1	PIF-BOGIE-01	R0	QUALITY ASSURANCE PLAN
D2	PIF-BOGIE-01	R0	WELDING SPECIFICATION
ANNEXURES			
F1	PIF-BOGIE-01	R0	SCHEDULE OF PRICES & GENERAL PARTICULARS
F2	PIF-BOGIE-01	R0	VENDOR PRE-QUALIFICATION CRITERIA
F3	PIF-BOGIE-01	R0	SCHEDULE OF GENERAL PARTICULARS / VENDOR EVALUATION FORMAT
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F5	PIF-BOGIE-01	R0	SCHEDULE OF TIME FOR MANUFACTURE, DESPATCH AND SHIPMENT TO SITE
F6	PIF-BOGIE-01	R0	SCHEDULE OF BIDDERS EXPERIENCE
F7	PIF-BOGIE-01	R0	DATA TO BE FILLED ALONG WITH BID FOR SUPPLY & COMMISSIONING OF BOGIE SYSTEM
F8	PIF-BOGIE-01	R0	CHECK LIST
F9	PIF-BOGIE-01	R0	BREAK UP DETAILS FOR BOUGHT OUT ITEMS
F10	PIF-BOGIE-01	R0	SCHEDULE FOR PERFORMANCE GUARANTEES
F11	PIF-BOGIE-01	R0	SCHEDULE FOR SUB-VENDORS

ENCLOSURES			
SR.NO	**DRAWING TITLE**	**DRAWING NUMBER**	**SHEET**
1	Wheel bogie – GA (Sheet 1 of 2)	DRAWING NO. TCE.10977A-ME-859-GA-0010 (SH 1 of 2)	1
2	Wheel bogie – GA (Sheet 2 of 2)	DRAWING NO. TCE.10977A-ME-859-GA-0010 (SH 2 of 2)	1

SECTION –A

GENERAL TERMS AND CONDITIONS OF THE CONTRACT

PROPOSAL DOCUMENT, CLARIFICATION AND ADDENDUM

Quotations are invited from the interested bidders for the enclosed scope of work in two-part bid. Part-1 technical & unpriced part of the work and Part-2 Priced commercial part.

Only experienced Bidders who are qualifying in bid-qualification criteria given in Section F2 only should quote.

The RFP document is organized in six sections as follows.

Section –A General Specification, Terms and Conditions of the Contract

Section –B Scope of Work & Technical Specifications

Section –C1 Bill of material for Bogie system

Section –C2 Hydraulic jack & power pack system

Section –C3 Painting specification for bogie system

Section –C4 Specification for Electrical system

Section –D1 Quality Assurance Plan.

Section- D2 Welding Specification.

Section-F Annexures.

Title of the proposal: *"Procurement, Manufacture, Supply, Erection, Testing and Commissioning of Bogie System for PIF".*

Date Public Notification issued by ISRO: as per the notification
Last Date of downloading tender Document by tenderer: as per the notification
Last date of submission of tender documents in online by tenderer: as per the notification
Last date of Bid sealing in online by ISRO: as per the notification
Last date for giving open authorization in online by tenderer: as per the notification

A. PROPOSAL DOCUMENT

1. Successful Bidder shall sign & stamp each page of the tender document (RFP) as token of his acceptance and submit the same.
2. Proposal documents shall remain the property of SDSC SHAR and shall not be used for any another purpose without the consent of SDSC SHAR.

3. The proposal shall be completely filled in all respects and Bid shall be tendered together with requisite information & Annexure. Any offer incomplete in any particulars is liable to be rejected.
4. The Proposal (Unpriced Techno-commercial bid) with a complete set of the required documents shall be up-loaded in ISRO e-procurement website.
5. The Proposals shall be submitted on-line in ISRO e-procurement portal before the time limit for bid submission specified in the Letter Inviting Bid.
6. Supplier shall submit the open authorization on line with in the time limit Specified in the Letter Inviting bid.
7. The Proposal will be opened on the date and on the time specified in the Letter Inviting Bid or as soon thereafter as convenient. Proposal not received in time will not be considered.
8. Bidders shall set their quotations in firm figures and without variations/additions in the terms of the Proposal documents.
9. **AMBIGUITY**

Should there be any ambiguity or doubt as to the meaning of any of the tender clause/condition or if any further information is required, the matter shall be immediately brought to the notice of Sr. Head, Purchase & Stores of SDSC SHAR in writing.

B. PREPARATION OF BIDS

1. SITE VISIT

Bidder is advised to visit & examine the site (if required) and its surrounding to familiarize himself of the existing facilities & environment and shall collect all other information which may be required for preparing & submitting the Bid and entering into the contract. Claims and objections due to ignorance of existing conditions or inadequacy of information will not be considered after submission of the Bid and during implementation.

2. VALIDITY OF OFFER

Bid shall remain valid for acceptance for a minimum period **of 4 (four) months** from the due date of submission of the Bid. The Bidder shall not be entitled during the said period to revoke or revise his Bid or to vary the Bid except and to the extent required by SDSC SHAR in writing. Bid shall be revalidated for extended period as required by SDSC SHAR in writing. In such

cases, unless otherwise specified, it is understood that validity is sought and provided without varying either the quoted price or any other terms & conditions of Bid finalized till that time.

3. COST OF BIDDING

All direct and indirect costs associated with the preparation and submission of bid shall be to Bidder's account and SDSC SHAR will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bid process.

4. APPLICABLE LANGUAGE/ MEASUREMENTS

The bid and all correspondence incidental to and concerning the bid shall be in the English Language. For supporting document and printing literature submitted in any other language, an accurate English Translation shall also be submitted. Responsibility for correctness in translation shall lie with the Bidder. All the measurements shall be given in metric system.

5. ARRANGEMENT OF BID

The Bid shall be neatly presented on white paper with consecutively numbered pages. It should not contain any terms and conditions which are not applicable to the Bid. The Bid and all details submitted by the Bidder shall be signed and stamped on each page as token of acceptance, by a person legally authorized to enter into agreement on behalf of the Bidder. (Corrections / alteration, if any, shall also be signed by the same person).

6. SCHEDULE OF PRICES

The schedule of prices shall be read in conjunction with all the sections of proposal document. The price must be filled online in the same format of ‘Schedule of Prices’ in **Section F1**. Hard copy of Price bid shall not be sent strictly. If hard copy of price bid is received the bid will be summarily rejected.

Price bid shall be filled in Price Bid form in e-procurement only. Price Bid annexures to be submitted in Price Bid supporting documents only and in e-procurement only.

Price bid shall not be enclosed along with Technical & Unpriced Commercial Bid.

7. DOCUMENTS COMPRISING THE BID

Bids shall be arranged in the following order.

A. Part – I: Technical and Unpriced Commercial Part

Technical and unpriced commercial part shall comprise the attachments, specifying attachment number arranged in the order as follows:

(a) Submission of bid letter.

(b) Demand draft of **Rs: 5 lakhs** as Earnest Money Deposit (EMD).

(c) Power of attorney in favor of authorized signatory of the bid / proposal documents.

(d) All the annexure in **Section-F1 to F11** (**F1 & F9** unpriced copies only) enclosed in proposal duly filled, signed and sealed.

(e) Bid qualification criteria for supply of Wheel Bogie system and all supporting documents.

(f) Temporary brackets / civil foundation for fixing pulleys / hooks **will not** be provided by SDSC SHAR for usage of winch/any other arrangement for assembly of bogie system. Hence, Write-up on the detailed procedure to be followed for erection and handling equipment including mobile cranes proposed to be used for erection of Wheel bogie system.

(g) Drawing of wheels and bearings.

(h) General arrangement drawings of wheel bogie.

(i) **Unpriced copy of** schedule of prices with all other commercial terms, taxes, duties, exemption certificates and conditions duly filled **(Prices to be kept blank**), signed and stamped. Bidder to clearly indicate “quoted” / “not quoted” against each sr.no in the price column in the unpriced schedule.

(j) Audited balance sheet including profit and loss account for F.Y. 2014-15, 2015-16 & 2016-17 showing annual turnover.

(k) Copy of the Income Tax returns filed for F.Y. 2014-15, 2015-16 & 2016-17.

(l) Current financial year solvency certificate from a scheduled bank for a value not less than Rs.160.00 Lakhs or above.

(m) Description of the procedures adapted for material procurement, fabrication with deviations from technical specification and proposed design modifications.

(n) Data sheets for all the bought out items & checklists enclosed in proposal duly filled, signed & stamped.

(o) Technical literature & data sheets of equipment / machinery used by him and any other document as mentioned in the proposal.

(p) Project execution plan

(q) Bar chart for supply & erection schedule indicating the date of completion of various activities so as to complete the execution of the contract within the time frame stipulated in the tender specification.

(r) Any other relevant document, bidder desires to submit.

(s) **Section: F9** should be submitted in price bid supporting documents and in e-procurement only.

(t) List of items and quantities which require Customs duty exemption certificate (CDEC) from SDSC-SHAR.

B. Part – II: Priced Commercial Bid

Priced commercial bid shall be filled on line in the price bid format in e-procurement. Schedule of prices/ Annexures also to be filled and uploaded in price bid supporting documents in e-procurement portal only.

No deviations, terms and conditions, assumptions, conditions, discounts etc. shall be stipulated in price bid. Department will not take cognizance of any such statement and may at their discretion reject such bids.

C. BID SUBMISSION

Bids duly filled in by the Bidder should invariably be submitted as stipulated in the Letter inviting bid. Bids shall be submitted in the following manner.

I. PART – I: UN PRICED TECHNO-COMMERCIAL PART OF THE BID FOR THE WORK

Complete Techno–commercial part of the bid shall be filled online in the "vendor Specified Terms' form of the e-tender. Any documents related (demand draft for tender fee & EMD), technical literature, guarantee / warrantee certificates and any other relevant documents as per the tender shall be scanned in lower resolution format and uploaded to the e-tender under 'Documents solicited from Vendor' form only in ISRO e-procurement portal (**https://eprocure.isro.gov.in**). In case if the space for uploading is not sufficient, hard copy of the balance documents shall be submitted before due date.

Envelope of technical bid shall be marked with following:

PART-I TECHNO-COMMERCIAL BID	
Name of client :	**Satish Dhawan Space Centre SHAR** Indian Space Research Organisation
Title of the proposal :	***"Supply, Erection, Testing and Commissioning of Bogie system for PIF"***
Tender Ref no:	
Due date and time of the opening :	DD/MM/YYY
From (Name of the bidder with address) :	
To: **Sr. Head, Purchase & Stores** **Satish Dhawan Space Centre** **SHAR** **ISRO, Dept. of Space** **Govt. of India** **Sriharikota – 524124,** **SPSR Nellore Dist,** **Andhra Pradesh, India**	

The deviation statement if any, and checklist shall be filled online, without which the bid will not be considered.

II. PART – II : PRICE PART OF THE BID FOR THE WORK

Price bid shall be filled in the on-line 'price bid' form of the e-tender only in ISRO eProcurement website https://eprocure.isro.gov.in. The cost of spares and other prices shall be filled in the respective forms available on-line in the eportal. Any other terms and conditions given in this part shall not be considered and if insisted upon by the Bidder, bids are liable for rejection.

a. SDSC SHAR may open Part – I of the bid on the due date of opening subject to meeting the minimum evaluation criteria. Price Bids (Part-II) of technically and commercially acceptable offers shall be opened at a later date.

b. SDSC SHAR reserves the right to reject any or all the Bids without assigning any reasons thereof.

c. Any bids/offers with price details in Techno-Commercial Offer (Part – I) shall be rejected.

d. SDSC SHAR reserve rights to place order for either full quantities of all items or partial quantities and partial items based on the unit rates available.

D. Vendor Evaluation Format

SDSC SHAR seeks response to the given questionnaire for assimilating data which would be used for evaluating the capability of the supplier for executing the referred work. Hence, the supplier is requested to provide only genuine data and any discrepancy found at a later point of time may result in rejection of the supplier from purchase process. Furnishing of data cannot be considered as automatic qualification for participation in the tender. Questionnaire should be signed by a responsible and authorized person of the Company / Agency.

Schedule of general particulars / vendor evaluation format shall be filled as per **Section: F3.**

Schedule of Bidders experience and details of present works being executed are to be filled as per **Section: F6**.

Note: In order to consider as valid experience, all the experience has to be supported with the technical details, completion certificate and purchase order.

E. DETERMINATION OF RESPONSIVENESS

SDSC SHAR will scrutinize tenders to determine whether the tender is substantially responsive to the requirements of the tender documents. For the purpose of this clause, a substantially responsive tender is one which inter-alia conforms to all the terms and conditions of the entire Tender document without any deviations and reservations. The decision of SDSC SHAR shall be final in this regard.

F. EARNEST MONEY DEPOSIT (EMD)

The tenderer has to submit an Earnest Money Deposit (EMD) for **Rs. 5.00 Lakhs** in a single installment through Demand Draft (DD)/ Banker's Cheque/ Fixed Deposit Receipts or Bank Guarantee from any of the Scheduled Banks executed on non-judicial stamp paper of appropriate value. In case of Bank Guarantee, it shall be valid for a period of 45 days beyond the final tender

validity date. It shall be taken in-favour of "Sr. Accounts Officer, SDSC SHAR" payable at State Bank of India, Sriharikota Branch. The bid will be disqualified if the EMD is not submitted along with the Techno-commercial Bid.

Foreign vendors, Registered vendors or vendors who have applied for renewal of registration, Central PSUs/ PSEs/ Autonomous Bodies, Micro and Small Enterprises, KVIC, National Small Industries Corporation, etc. shall be exempted from the payment of EMD. Vendors seeking exemption from payment of EMD shall submit the necessary documentary proof.

EMD of a vendor shall be forfeited, if the tenderer/Contractor withdraws or amends his tender or deviates from the tender in any respect within the period of validity of the tender. Failure to furnish Security Deposit/ Performance Bond by a successful vendor within the specified period shall also result in forfeiture of EMD.

EMD shall be refunded to all the Unsuccessful vendors within 30 days after placement of the Purchase Order. EMD shall be refunded to the successful Tenderer/Contractor after payment of Security Deposit (SD) or may be adjusted against the Security Deposit (SD). EMD shall be refunded to all the participants in cases where the Tender is cancelled or withdrawn by the Centre/ Unit, within 30 days from the date of such cancellation or withdrawal.

G. BID EVALUATION

I. During evaluation, SDSC SHAR may request Bidder for any clarification on the bid OR additional documents.

II. Techno-commercial discussion shall be arranged with Bidder, if needed. Bidder shall depute his authorised representatives for attending discussions. The representatives attending the discussions shall produce authorisation from his organisation to attend the discussion and sign minutes of meeting on behalf of his organisation if required. The authorised representative must be competent and empowered to settle/decide on all technical and commercial issues.

III. Bidder must provide the point by point compliance to the technical specifications along with deviations as per "Schedule of deviations" attached in **section F4**. The tender will be rejected, if the deviations are not acceptable to the Department.

IV. Performance of Bidder in similar nature of works executed/ under execution shall be taken into consideration before selecting the Bidder for opening his price bid.

V. The time schedule for completion is given in the Proposal document. Bidder is required to confirm the completion period unconditionally.

VI. SDSC SHAR reserves the right to accept a bid other than a lowest and to accept or reject any bid in full or part without assigning any reasons. Such decisions by SDSC SHAR shall bear no liability whatsoever consequent upon such decision.

VII. SDSC SHAR reserves the right to split the order or alter the quantities specified based on prices quoted for part work or unit rate quoted by BIDDER.

VIII. The Bidder, whose bid is accepted by SDSC SHAR, shall be issued a Letter of Intent (LOI) /Purchase Order (PO) to proceed with the work. Successful Bidder shall confirm acceptance by returning a signed copy of the LOI/PO.

GENERAL SPECIFICATION

1. INTRODUCTION

SDSC SHAR invites for tenders in sealed covers from reputed firms with proven ability to ***"Procurement, Manufacture, Supply, Erection, Testing and Commissioning of Bogie System for PIF"*** as per the specifications

2. SCOPE OF WORK AND TECHNICAL SPECIFICATIONS

The detailed scope of work and technical specifications are given in Sections B, C D1, & D2 of RFP document. The general terms and conditions are given below.

3. SUPPLIER's OBLIGATIONS & FUNCTIONS

3.1. SPECIFICATIONS AND DRAWINGS

The Supplier shall execute the works in compliance with the provisions of CONTRACT, good engineering practices and codes requirements.

3.2. SUBMISSION OF TECHNICAL DOCUMENTS

Supplier shall prepare and submit to SDSC SHAR for approval of following documents and drawings:

3.2.1. Technical literatures & data sheets of equipment used by him.

3.2.2. General arrangement drawings of the bogie system and assembly plan at supplier site.

3.2.3. Details of heat treatment / stress relieving equipment.

3.2.4. Details of Turning machines / milling machines to be used for machining.

3.2.5. Assembly Shop layout drawings suitable for control assembly of drives.

3.2.6. Erection sequence schedule along with erection drawings.

3.2.7. Detailed Quality Assurance Plan

3.2.8. No activity shall be executed unless SDSC SHAR's approval is obtained. The above documents shall be submitted in a format approved by SDSC SHAR.

3.3. PROCUREMENT, FABRICATION & SUPPLY

Supplier shall carry out procurement, fabrication and supply of the Wheel bogie system in accordance with the scope, technical specifications and terms & conditions of contract.

3.4. DELIVERY AND STORAGE

3.4.1. Dispatch Instructions given in the Contract shall be strictly followed. Failure to comply with the instructions may result in delay in payment apart from imposing any other charges as may be deemed to fit.

3.4.2. The Supplier shall be responsible for transporting all the equipment to site, unloading and storage.

3.4.3. No equipment shall be delivered without obtaining dispatch clearance from SDSC SHAR.

3.4.4. All the equipment shall be properly packed to avoid any damage during transportation / handling / storage and any damage found has to be replaced free of cost.

3.4.5. The equipment received at site shall be stored at a place assigned for this purpose.

3.4.6. Supplier shall take proper care while storing the equipment and shall provide watch & ward at his own cost.

4. INSTALLATION

4.1. GENERAL

4.1.1. Supplier’s staff shall include adequate number of competent erection engineers with proven experience on similar works to supervise the erection works and sufficient skilled, unskilled and semiskilled labour to ensure completion of work in time.

4.1.2. Supplier's erection staff shall arrive at site on date agreed by SDSC SHAR. Prior to proceeding to work, Supplier shall however, first ensure that required/sufficient part of his supply has arrived at site.

4.1.3. Erection of equipment may be phased in such a manner so as not to obstruct the work being done by other Suppliers and / or operating staff who may be present at that time.

4.1.4. During erection, Department's quality team / their engineer will visit site From time to time with or without Supplier’s engineer to establish conformity of the work with specification. Any deviations, deficiencies or evidence of unsatisfactory workmanship shall be corrected as instructed by Department.

4.1.5. Supplier shall carry out work in a true professional manner and strictly Adhere to the approved drawings. Any damage caused by Supplier during erection to new or existing building / environment shall be made good at no extra cost to Department.

4.2. RECORDS

Supplier shall maintain records pertaining to the quality of erection work in a format approved by Department. Whenever erection work is complete, Supplier shall offer erected equipment for inspection to Department's engineer who along with Supplier's engineer will sign such records on acceptance.

4.3. WHEEL BOGIE SYSTEM ERECTION/ASSEMBLY

4.3.1. Supplier shall carry out the works in accordance with the specific Instructions given on the approved drawings, method statements, manufacturer’s drawings / documents or as directed by Department. Equipment shall be erected in neat manner so that they are level, plumb, and square and properly aligned and oriented. Tolerances shall be as established in manufactures drawings or as stipulated by Department. No equipment shall be welded or bolted, until its alignment is checked and found acceptable by Department.

4.3.2. Supplier shall provide all supervision, labour, tools, machines, cranes, equipments, scaffolding, rigging material and incidental material such as bolts, wedges, anchors, etc. required to complete the works. Supplier shall also provide at his own cost all such consumables like oxygen – acetylene gas, welding rods, grinding wheels, temporary supports, shims etc. required to complete work.

4.3.3. Supplier shall take utmost care while handling instruments, delicate equipment, panels etc. and protect all such equipment on erection.

4.4. SAFETY

Supplier shall follow the safety regulations / codes and shall take necessary measures at his own cost.

4.5. ERECTION & CONSTRUCTION POWER

4.5.1. Electrical power and available material handling equipment subject to availability may be extended by SDSC SHAR on chargeable, as per the tariff rules of State Electricity Board and SDSC SHAR. Reasonable quality of normal Construction power will be made available at one point which is 100m away from the work site (415V, 3 phase, 50 Hz). However onward distribution shall be by the supplier. Installation of necessary power cables of 100m or more, energy meters, switchgear & distribution system, etc. for

Construction power in a safe manner in strict conformity with local rules & regulations will be the responsibility of supplier.

4.5.2. During non-availability of power, supplier shall make his own arrangement of alternate power source at their cost.

4.6. WORK RULES AT SDSC-SHAR

The work shall be carried out in SDSC-SHAR working days only or permission to be obtained from the contract manager for late hours / holidays.

4.7. SITE PREPARATION / CLEARANCE

No site preparation works are planned by SDSC SHAR for site fabrication works. Only environmental clearance will be provided for site preparation works. Preparation of required site for fabrication and approach requirements for handling the wheel bogie systems shall be in scope of contractor. The site identified in such works shall be within 400 mtr from the PIF building location.

Upon completion of work, supplier shall remove all his equipment and material from the site within one month or time mutually agreed. Supplier at all times shall keep site in clean condition and remove all unwanted material at regular intervals. In case supplier fails to remove all their equipment and material within the mutually agreed time, it is deemed that SDSC SHAR will arrange to remove the same at Supplier's cost.

5. ACCOMMODATION

Accommodation will not be provided by SDSC SHAR to Contractors. Supplier shall make their own arrangement for accommodation, transportation & canteen facility for all his staff, technicians, labour & workers.

6. MEDICAL FACILITIES

No medical facilities will be provided by SDSC SHAR. Supplier shall make their own arrangement at their own expenses for medical facilities for site personnel.

7. WORK PROGRAMME

Supplier shall prepare a detailed program schedule for review / approval by SDSC SHAR. Supplier as per exigencies of work shall revise and update programme periodically.

7.1. SUB-CONTRACTS

7.1.1. No work shall be sub-contracted without prior approval of SDSC SHAR.

7.1.2. Supplier shall be responsible for the proper execution of any sub-contract placed by him in connection with this purchase order.

7.1.3. Supplier shall furnish to SDSC SHAR the copies of all un-priced sub-orders showing promised delivery dates and places.

8. CHANGES AND MODIFICATION TO SPECIFICATIONS, DRAWINGS AND QUALITATIVE / QUANTITATIVE REQUIREMENTS

8.1.1. Supplier shall obtain approval from SDSC SHAR before initiating the action for procurement of bought out items.

8.1.2. During the fabrication review, supplier has to carry out the mutually agreed modifications to meet the overall requirement.

9. RECORD OF DRAWINGS AND O&M MANUALS

9.1. Supplier shall submit 3 hard copies & one soft copy of all the approved drawings incorporating any modification / changes made during the execution of CONTRACT. All these drawings shall be marked as 'As Built'.

9.2. Supplier shall submit 3 hard & one soft copy of O&M manual. These manuals should indicate weekly, monthly and yearly maintenance schedule and other instructions necessary for safe maintenance of equipment.

9.3. Submission of the drawings and manuals shall be a precondition for releasing of any final payment due to Supplier.

10. TAXES AND DUTIES

10.1. As per Notification No. 47/2017-Integated Tax (Rate) Dt: 14.11.2017 issued by Ministry of Finance (Dept. of Revenue), SDSC SHAR is eligible to avail a reduced rate of IGST@5% for the procurements of goods made by the Dept. of Space (DOS) being a Public Funded Research Institution. We will provide IGST Exemption Certificate. However, for supply of services the bidders have to consider applicable GST rates.

10.2. CGST/SGST/UTGST/IGST (whichever is applicable) shall not be included in the lump sum quote, but indicated (both percentage of tax applicable & amount on which it is applicable) separately in schedule of prices.

10.3. It is the responsibility of the contractor to issue the Tax Invoice strictly as per the format prescribed under the relevant applicable GST law (CGST Act/SGST Act/UTGST Act/IGST Act). Contractor to indicate the proper GSTN Registration/ HSN code in their tax invoices.

10.4. CGST/SGST/UTGST/IGST shall be paid at actuals against Tax Invoice but restricted to the amount and percentage in the contract.

10.5. GST details of SDSC SHAR are given below

GSTIN: 37AAAGS1366J1Z1

LEGAL NAME: SATISH DHAWAN SPACE CENTRE SHAR

VALIDITY FROM: 29/08/2017

TYPE OF REGISTRATION: REGULAR

11. STATUTORY VARIATION

Statutory variation for CGST/SGST/UGST/IGST is applicable, provided the actual completion of services does not occur beyond the period stipulated in the order/contract or any extension (without levy of penalty). For variation after the agreed completion periods, the service provider alone shall bear the impact for the upwards revisions.

For downward revisions, the Department shall be given the benefit of reduction in CGST/SGST/UGST/IGST.

12. CUSTOMS DUTY

12.1. As per Notification No. 05/2018 CUSTOMS Dt. 25.01.2018 ISRO is eligible to pay reduced rate of Customs duty at 5% + Surcharge (10 % on CD) + 5% IGST (on total value viz. basic cost + CD + Surcharge) (We will provide Customs Duty Exemption Certificate in case of Import Orders/ imported supplies/ High Sea Sales). This may be taken into account while considering the cost of import items, if any.

12.2. Customs clearance and other formalities at the destined port within the country shall be handled by the Supplier at his own cost. Further the transportation from the port to the work of Supplier or site shall be arranged by Supplier at his own cost.

13. RISK COVERAGE

The Supplier shall arrange comprehensive risk coverage at his own cost covering the value of equipment including transportation to the site from manufacturer’s works, storage at site, erection, testing and commissioning at site. The period of such coverage shall be up to contractual completion period or any extension granted by Department thereof.

14. INCOME TAX

Income tax at the prevailing rate as applicable from time to time shall be deducted from the supplier's bills as per Income Tax Act, 1961 and the rules there-under or any re-enactment or modifications thereof and a TDS certificate shall be issued.

15. SECURITY DEPOSIT

15.1. The supplier, whose tender is accepted, will be required to furnish by way of security deposit for the due fulfilment of the contract such a sum as will amount to 10 % of the contract price of the work awarded.

15.2. The security deposit (bearing no interest) shall be held by the Department as security till satisfactory completion, testing and handing over of all the system and for the due performance of all suppliers' obligations under the contract as per delivery period or extension granted thereof by the Department.

15.3. The supplier within 10 days of Purchase Order or signing of Contract, deposit the security deposit with the Accounts officer, Satish Dhawan Space Centre SHAR, Sriharikota as detailed above by any one or more of the following modes namely

I. By a crossed demand draft in favour of Accounts officer, Satish Dhawan Space Centre SHAR drawn on SBI and payable at Sriharikota.

II. By a bank guarantee in the prescribed format (required format will be provided after award of contract). The bank guarantee shall be from a nationalized / scheduled bank for & shall be valid for 60 days beyond completion period.

15.4. In case of breach of contract, the Security deposit shall stand forfeited in addition to other relief available to the Department under this contract.

16. PACKING AND FORWARDING

16.1. The Supplier shall arrange to have all the material suitably packed as per the standards and as specified in the contract. Unless otherwise provided for in the contract, all containers (including packing cases, boxes, tins, drums, and wrappings) used by the Supplier shall be non-returnable.

16.2. All packing and transport charges, transit handling costs, transit risk coverage and transport fees of agents employed at the place of delivery or elsewhere, shall be deemed included in the price to be paid to the Supplier.

17. ARBITRATION

In the event of any question, dispute of difference arising under these conditions or any conditions contained in the Purchase Order or in connection with this contract, (except as to any matters the decision of which is specially provided for by these conditions) the same shall be referred to the sole arbitration of the head

of the Purchase Office or some other person appointed by him, it will be no objection that the arbitrator is a Government Servant that he had to deal with matter to which the contract relates or that in the course of his duties as Government Servant he had expressed views on all or any of the matters in disputes or difference. The award of the arbitrator shall be final and binding on the parties of this contract.

It is Term of this contract:

a. If the arbitrator be the head of the purchase office.
   I. In the event of his being transferred or vacating his office by resignation or otherwise, it shall be lawful for his successor-in office either to proceed with the reference himself, or to appoint another person as arbitrator, (or).
   II. In the event of his being unwilling or unable to act for any reason, it shall be lawful for the Head of the Purchase Office to appoint another person as arbitrator: or

b. If the arbitrator be a person appointed by the Head of the Purchase Office in the event of his dying, neglecting or refusing to act, or resigning or being unable to act, for any reason, it shall be lawful for the Head of the Purchase Office either to proceed with the reference himself or to appoint another person as arbitrator in place of the outgoing arbitrator. Subject as aforesaid, the Indian Arbitration and Conciliation Act, 1996 and the rules there under and any statutory modifications thereof for the time being in force shall be deemed to apply to the arbitration proceedings under this Clause. The arbitrator shall have the power to the extent with the consent of the Purchaser and the Contractor the time making and publishing the award. The venue of arbitration shall be place as the purchaser in his absolute discretion may determine. Work under the Contract shall, if reasonably possible, continue during arbitration Proceedings.

c. In case order is concluded on the public Sector Undertakings, the following Arbitration Clause will be applicable.

   In the event of any dispute or differences relating to the interpretation and application of the provisions of contracts, such dispute or difference shall be referred by either party to the Arbitration of one of the Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Bureau of Public Enterprises. The Indian

Arbitration and Conciliation Act, 1996 shall not be applicable to the Arbitration under this clause. The award of the arbitrator shall be binding upon the parties to the dispute provided, however, any party aggrieved by such award may make a further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law & Justice, Government of India. Upon such Additional Secretary when so authorised by the Law Secretary whose decision shall bind the parties finally and conclusively. The parties to the dispute will share equally the cost of arbitration as intimated by the arbitrator.

18. APPLICABLE LAW AND JURISDICTION

The laws of India shall govern this purchase order for the time being in force. The Courts of Andhra Pradesh, India only shall have jurisdiction to be with and decide any legal matters or disputes what so ever arising out of the purchase order.

19. FORCE MAJEURE

Should a part or whole work covered under this purchase order be delayed due to reasons of Force Majeure which shall include legal lockouts, strikes, riots, civil commotion, fire accident, quarantines, epidemic, natural calamities and embargoes the completion period for work, equipment referred to in this agreement shall be extended by a period not in excess of the duration of such Force Majeure. The occurrence shall be notified within reasonable time.

20. GUARANTEES

The Supplier shall guarantee that the equipment furnished by him is in conformance with the requirement of the specifications. Goods covered by the contract shall be free from defects in materials or workmanship for a period of **Twelve months** from the date of successful commissioning & acceptance by Department.

21. WARRANTY

The bidder shall provide ***12 months'*** warranty for the entire system for a defect liability, after final official handing over at his cost. During this period, supplier has to provide and adhere to the following:

21.1. He has to attend quarterly based preventive maintenance visits and breakdown maintenance calls. All the defective components have to be replaced or rectified on one to one basis.

21.2. Break down maintenance should be responded within 48 Hours' time and shall be completed within 48 Hours after respond.

21.3. Department will not provide any transport/accommodation.

21.4. In case vendor failed to attend and repair the system within 7 days from the date of reporting the problem, Department will reserve right to forfeiting the BG apart from withheld of any payment payable to the vendor.

21.5. Where defects in items are remedied under warranty, the period for which the warranty operates shall be extended by such period, as the items were not available to SDSC SHAR. Where defect items are replaced by new ones, the full warranty period stipulated in the purchase order shall apply to such replacement items as from the date of their delivery.

22. SCHEDULE OF PRICE

22.1. CONTRACT price shall include all costs of "Procurement, Manufacture, Supply, Erection, Testing and Commissioning of Wheel bogie system for PIF", shop testing, packing, forwarding, transport to site, unloading, storage, all risk coverage, erection, installation, testing & evaluation and commissioning of equipment including any other cost for proper and complete execution of the CONTRACT.

22.2. CONTRACT prices shall also include all travelling expenses, living expenses, salaries, overtime, benefit and any other compensation for engineers, supervisors, skilled, semiskilled workmen, watch and ward staff, labours and other staff employed by the Supplier, cost of tools and tackles required for erection and other consumable material required, and all taxes, duties, and levies as applicable on the date of submission of bid.

22.3. Supplier shall quote the prices similar to price bid format enclosed as Section –F1 only in online.

22.4. Erection charges and third party inspection charges shall be firm and fixed even for the **± 15%** quantity variations also.

22.5. The contractor shall agree for addition / deletion of the works for the same quoted unit rates and such variation is limited to ± 15% of the ordered quantities.

22.6. The rate quoted shall be on FOR SDSC SHAR, Sriharikota basis.

22.7. The taxes applicable for supply and erection & commissioning shall be indicated separately in the price bid. If the offers submitted by the tenderers

are silent on taxes, it will be presumed that quoted rates are inclusive of taxes & duties and no claim in this regard will be entertained later.

23. DISCOUNTS

Tenderer shall not indicate any discount separately and quoted price should be after deducting the discount.

24. MODE OF PAYMENT

All the payments due to Supplier will be made in Indian currency by crossed "Account Payee" cheque sent to the registered office of the Supplier. Bidders can submit the banker details and payments can also be made through ECS.

25. TERMS OF PAYMENTS

General guideline terms of payments are as indicted below. Any deviation to these payment terms to be brought out.

25.1. FOR SUPPLY OF ITEMS INLCUDING BOUGHTOUT ITEMS (i.e. supply of fabrication items, supply of fabricated machined items, supply of forging machined items & supply of Bought out items)

25.1.1. **30%** of supply cost as advance against submission of bank guarantee for an equal amount from a reputed nationalized/scheduled bank and shall be valid till Contract completion period. Format of Bank guarantee shall be obtained from Department after award of contract.

25.1.2. **60%** of supply cost payment against receipt of material at Purchasers / Department site on pro-rata basis, along with GST (including for advance portion).

25.1.3. **10%** of supply cost after successful commissioning & acceptance by Department of equipment and system covered under contract and against submission of Performance bank guarantee of equal amount valid till warranty period plus 3 months claim period.

25.2. FOR ERECTION, TESTING AND COMMISSIONING OF WHEEL BOGIE SYSTEM AT SITE

25.2.1. **20%** of erection cost as advance after commencement of works at site & against submission of bank guarantee valid till erection, commissioning and acceptance.

25.2.2. **70%** of erection cost against pro-rata progress at site (duly accepted by Department) along with GST (including for advance portion).

25.2.3. **10%** of erection cost along with GST after successful commissioning and acceptance by Department of equipment and system covered under contract and against submission of performance bank guarantee of equal amount valid for guarantee/warranty period.

25.3. FOR THIRD PARTY INSPECTION CHARGES

25.3.1. **50%** of third party inspection charges after receipt of complete material at purchasers / Department site.

25.3.2. **50%** of third party inspection charges along with GST after Erection, Commissioning and acceptance of the system.

25.4. PERFORMANCE BANK GUARANTEE

25.4.1. The supplier shall guarantee for the performance of the equipment by providing bank guarantee in favor of the Department for an amount equivalent to **10 %** (ten percent) of the total value of this contract valid till the warranty period of the contract plus 3 months claim period.

25.4.2. The performance bank guarantee shall be submitted by the supplier with in fifteen days from the date of accepting the equipment as per the CONTRACT. Format for the performance bank guarantee shall be obtained from the Department.

26. DELIVERY SCHEDULE

The realization of fabrication works within the schedule is very essential. Hence, bidders are requested to adhere to the schedules given below. Contractor shall follow the following schedule for executing the contract:

S.No	Description of Target	Responsibility	Target Completion Date
1	Purchase Order release	Dept.	T
2	Procurement, fabrication / machining, control assembly, inspection, handling, assembly & test run at suppliers site and receipt of all items at department site after dispatch clearance by dept.	Vendor	T + 8 months
3	Clearance for Erection at Department Site.	Dept.	T1>=(T+8 months)
4	Assembly testing and trial run at Department site.	Vendor	6 weeks from date of site clearance for erection

27. LIQUIDATED DAMAGES

In the event of the Supplier failing to complete the work within the delivery period specified in the contract agreement or in extension agreed thereto, Department shall reserve the right to recover from the Supplier as liquidated damages, a sum of 0.5 percentage per week or part thereof of the undelivered portion of the total contract price of equipment or work. However, the total liquidated damages shall not exceed **10.0** percentage of the total Contract price. The LD reckoning date shall be **T+8 months** for supply portion and **6 weeks** from the date of site clearance (T1) for erection & commissioning and testing and trial run portion of the contract price.

28. DISCLOSURE AND USE OF INFORMATION

28.1.1. If the documents supplied by SDSC SHAR are marked **"Strictly Confidential"**, supplier shall take all necessary steps to ensure the same.

28.1.2. Supplier shall guarantee that all information and data received during execution of Purchase Order from SDSC SHAR shall be classified as **"confidential"** within the meaning of the Official Secrets Act and will not be divulged to any third party without prior written permission of SDSC SHAR. All drawings & documents shall be returned after execution of work.

28.1.3. No publicity of any kind whatsoever regarding this work shall be given without prior clearance from SDSC SHAR.

29. ACCEPTANCE AND REJECTION:

On completion of the work or part of the work as specified in the contract, the representative of the Department referred to, shall check as soon as possible, but in any event within one month of notification of readiness for acceptance that the work performed complies with the contract requirements as regards quantity and quality.

In the event of rejection of any of the articles, whereby the Supplier feels himself aggrieved, he may within eight days of the receipt of notification of rejection and before such articles have been removed from the place of inspection, give the Department notice of objection. Such objection shall be considered by a Board of Appeals of the Department. The Department shall, without prejudice to the arbitration clause in the contract, take a decision upon presentation of the Board's findings.

On completion of tests, the members of the Inspection Organisation of the Department or Inspection agency appointed by Department shall prepare a report, which must be countersigned by the Supplier.

30. SUSPENSION:

30.1. Department may notify the Supplier to suspend performance of any or all of his obligations under the Contract. Such notice will specify the reasons for suspension and the effective date of suspension. Supplier there upon shall suspend the performance of such obligations until ordered in writing to resume performance of Contract by Department.

30.2. If Supplier's performance or his obligations remain suspended or the rate of progress is reduced, then, the time of completion will be suitably extended and all costs incurred by Supplier as a result of suspension or reduction in rate of progress will be paid to Supplier provided that the suspension or reduction in the rate of progress is not by reasons of Supplier's default or breach of Contract.

31. CANCELLATION

31.1. GENERAL RULE

The Department shall have the right at any time to cancel a contract either wholly or in part by giving written notice by registered mail. From the time of receipt of the written notice, the Supplier shall undertake to observe the instructions of the Department as to the winding up of the contract both on his own part and on the part of his sub-suppliers.

31.2. WITHOUT FAULT OF SUPPLIER

In the case of cancellation of a contract by the Department without any fault of the Supplier, the Supplier shall on receipt of Department's instructions forthwith take the necessary steps to implement them. The period to be allowed to implement them shall be fixed by the Department after conclusion with the Supplier and, in general, shall not exceed three months.

Subject to the Supplier confirming, Department shall take over from the Supplier at a fair and reasonable price all finished parts not yet delivered to the Department, all unused and undamaged material, bought-out components and articles in course of manufacture in the possession of the supplier and property obtained by or supplied to the Supplier for the performance of the contract, except

such material, bought-out components and articles in course of manufacture as the supplier shall, with the agreement of the Department, elect to retain.

31.3. WITH FAULT OF SUPPLIER:

The Department reserves the right, after full consideration of all relevant circumstances, including the observations of the supplier, to cancel a contract in any of the following circumstances.

31.3.1. In the event of the Supplier's failure to meet

I. The Technical requirements of the Supplier.

II. The Progress and/or delivery requirements.

31.3.2. If the Supplier has not observed the provisions of the contract concerning the disclosure and use of information provided by the Department.

31.3.3. If the Supplier fails to comply with the provisions of the contract concerning the equipment, supplies and technical documents made available by the Department.

31.3.4. If the Supplier transfers his contract without the Department's authorization or concludes sub-contracts against the Department's explicit directives.

In the event that Supplier unjustifiably repudiates the Contract or fails to ship or dispatch all or part of the goods ordered for reasons other than those attributed to the Department’s actions or as provided in the Force Majeure clause, the Department may, by giving an appropriate notice in writing to the Supplier, fix a Date of Essence by which the Supplier must complete the dispatch in full. If the Supplier fails to do so, the Department, in addition to his right to recover Liquidated Damages in terms of the Contract, shall also have the right to cancel this Contract and make substitute purchases from other sources. If the goods are in a partial state of fabrication, Department may have the fabrication completed by other means, in which event Supplier shall be liable to Department for the additional expenses incurred thereby, but shall not have any claim on savings, if any, in such cases.

In the event of such cancellation, the Department shall unless otherwise specified in the contract, only pays,

- In the case of a fixed-cost contract for the supply of equipment or material. The contractual value of items delivered and accepted under the contract

before receipt of notification of cancellation, or to be accepted under the special conditions of cancellation.

- In the other cases, a fair and reasonable price in respect of such work as has been carried out prior to the receipt by the Supplier of notification of cancellation.

32. FRAUDULENT PRACTICES, BRIBERY AND CORRUPTION OF GOVERNMENT SERVANTS

The contractor represents and undertakes that he has not given, offered or promised to give, directly or indirectly any amount, gift, consideration, reward, commission, fees, brokerage or inducement to any person in service of the department or otherwise in procuring the contracts or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of the contract or any other contract with the Government for obtaining a contract or showing or forbearing to shoe favour or disfavour to any person in relation to the contract or any other contract with the government. Any breach of the aforesaid undertaking by the contract or any one employed by him or acting on his behalf or for his benefit (whether with or without the knowledge of the contractor) or the commissioning of any offence by contractor or any one employed by him or acting on his behalf, as defined in chapter IX of the Indian Penal code, 1860 or the prevention of corruption Act. 1947 or any other Act enacted for the prevention of corruption shall, without prejudice to any other legal action, entitle the Department to cancel the contract either wholly or in part, and all or any other contracts with Contractor and recover from the Contractor such amount or the monetary value thereof and the amount of any loss arising from such cancellation without any entitlement or compensation to the Contractor. The Department will also have the right to recover any such amount from any contracts concluded earlier between the contractor and the Government of India. The contractor will also be liable to be debarred from entering into any contract with the Government of India for a minimum period of five years. A decision of the Department to the effect that a breach of the undertaking had been committed shall be final and binding on the Contractor.

PROJECT INFORMATION

1.0 Project Title : PSLV Integration Facilities (PIF)

2.0 Location of Plant : Shriharikotta, AP

3.0 Elevation : 4.2 m

4.0 Access to Site : Road
From North of Chennai is apprx. 100 km.
From East of Sullurpetta in Nellore dist is approx 28km.

Rail
Chennai – Vijayawada rail track line.

5.0 Terrain : Uneven with level varying significantly.

6.0 Climatic Conditions

a) Temperature

Mean of daily max	:	42.2 ^{0}C
Mean of daily min.	:	11.8 ^{0}C
Maximum Temperature	:	44.6 ^{0}C

i. Design ambient temperature for performance guarantee : 45.0 ^{0}C

ii. For electrical system design : 50 ^{0}C

b) Relative humidity

i. Range : 15% to 100%

ii. Design relative humidity for performance guarantee : 70%

c) Rainfall

i. Annual average maximum : 1331.3 mm

7.0 Wind Load

Basic wind speed : 65m/s
(Enhanced by a factor 1.3)

8.0 Seismic Data : As per IS : 1893 latest issue
Zone : Zone III

9.0 Auxiliary Power Supply : Electrical equipment to be

supplied against this specification shall be suitable for operation on the following supply system:

a. For motors rated 200Kw : 415V, 3-phase, 3-wire, effectively and below and motors rated upto 250kW with VFD earthed AC

b. Uninterrupted power supply : 230 V, 1 phase, 50 Hz, 2 wire AC supply

c. Space heaters (for motors rated 30kW and above) : 240V, 1-phase, 2 wire, 50Hz AC system with effectively earthed neutral.

d. Instrumentation controls : 24V, (including solenoid valves) and annunciation for instrumentation system only. This power supply has to be derived by the vendor from AC UPS supply.

e. Lighting fixtures : 240V, 1 phase, 2 wire, 50 Hz, earthed system.

f. Space heaters in panels : 240V, 1 phase, 2 wire, 50 Hz, earthed system

g. Construction power : 415 V $\pm$ 10%, 3 phase, 4 wire, 50 Hz $\pm$ 5%, AC supply at one place. Further distribution by Bidder

h. All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without change in their performance :

AC supply : Voltage variation $\pm$ 10%

Frequency variation $\pm$ 5%

Combined voltage & Frequency variation : 10%

SECTION –B

SCOPE OF WORK & TECHNICAL SPECIFICATION

1.0 SCOPE

This specification covers the general requirements for preparation/revision of drawings, supply of material, manufacture, testing, inspection at CONTRACTOR'S works, packing, forwarding, transportation, transit insurance, delivery at site, erection / installation, testing, commissioning at site and carrying out performance / acceptance tests of the equipment under the supervision of ISRO & Third Party Inspection Agency (TPIA), materials and services as per enclosed data sheets and other documents. The scope of work shall also include collection of free issue items (if any) from PURCHASER, assembling the same with manufactured items of VENDOR and despatching along with the final products.

2.0 BACKGROUND INFORMATION

2.1 After the assembly of launch vehicle on Mobile Launch Pedestal (MLP), the same is transported by a Wheel Bogie from PIF Integration building to the First Launch Pad (FLP) for launching operation.

2.2 In PIF integration building, the MLP is positioned & anchored to Ground Anchors and the launch vehicle is assembled on MLP. When MLP with launch Vehicle has to be transported to launch pad, the Wheel Bogie is positioned under the MLP. There are Four Nos. of MLP Lifting Jacks resting on Wheel Bogie for lifting the "MLP & Vehicle". The bearing plates positioned between MLP and Ground Anchors are removed and then the MLP Lifting Jacks are lowered so that the "MLP & Vehicle" rests on the Bogie for transportation to launch pad. Wheel Bogie along with MLP and Launch Vehicle is moved on Single Rail Track by means of a Hauler moving on road paved between the Single Rail Track. A Reverse sequence is followed when "MLP & Vehicle" is to be anchored in launch pad area / parking area.

3.0 EQUIPMENT AND SERVICES TO BE PROVIDED BY CONTRACTOR

The Equipment and Services for Wheel Bogie to be provided by the CONTRACTOR shall be inclusive of but not limited to the following items:

3.1 Wheel Bogie system (1 No.)

3.2 Collection of free issue items (if any) from the DEPARTMENT against indemnity bond and insurance for the value of free issue items, packing, transportation to their works site, assembly with fabricated structure and transportation back to SDSC SHAR.

3.3 Additional supports, lugs, Bolts and Nuts required during control assembly of modules at shop and prior to welding of modules at site.

3.4 Laying of 25m long Single Rail Track for Control assembly of the Wheel Bogie Structure. All accessories (including the rails) for laying / fixing Rail track are in the scope of the CONTRACTOR.

3.5 Shop assembly, Erection, Inspection & Testing, Packing & Forwarding, transportation to site, unloading & storage at site.

3.6 Erection, Commissioning and Performance Testing of the Wheel Bogie at site.

3.7 Minor Fabrication / improvement works on Wheel Bogie at site.

3.8 Painting of all equipment at CONTRACTOR's SHOP as well as at site as per the detailed specifications duly approved by the PURCHASER.

3.9 First fill of oil, grease, lubricants consumables, etc. as required during Start up and Commissioning operations.

3.10 PREPARATION / REVISION OF DRAWINGS AND DOCUMENTS:

After the Award of CONTRACT, the PURCHASER shall provide a set of drawings for the proposed Wheel Bogie to the CONTRACTOR. The CONTRACTOR shall carry out preparation / revision of drawings in order to incorporate any subsequent modifications required in the drawings before and during the manufacture of Wheel Bogie. Some of the conditions due to which modifications in drawings may be necessary are stated here below:

a) Preparation / Revision of drawings to incorporate the Technical Deviations / Design modifications proposed by the CONTRACTOR and accepted by the PURCHASER.
b) Preparation / Revision of drawings to incorporate modifications in the Wheel Bogie as specified by the PURCHASER after the award of CONTRACT.
c) Preparation / Revision of drawings to incorporate changes in Bought-out components.
d) Any other changes in the design / drawings for Wheel Bogie found necessary to be carried out during various stages of manufacture and erection of Wheel Bogie.

4.0 EQUIPMENT AND SERVICES TO BE PROVIDED BY DEPARTMENT

4.1 Rail Track for movement of Wheel Bogie at site (SDSC SHAR).
4.2 Mobile Launch Pedestal (MLP) for interface checks at DEPARTMENT's site after erection.
4.3 Towing Hitches for hauling Wheel Bogie along with MLP and Launch Vehicle will be provided at site. Towing Hitches shall be mounted by the CONTRACTOR on Front and Rear end of the Wheel Bogie.
4.4 Hauler for moving of Wheel Bogie on Single Rail Track shall be provided at DEPARTMENT’s site during Commissioning and Performance Testing.

5.0 TECHNICAL SPECIFICATION OF WHEEL BOGIE

Capacity of each of the four Bogies	200 T
Location of Bogies below MLP	One (1 no.) Each at four (4) corners of 7.5 m x 7.5 m square
Span of Rail track	7.5 m center to center
Tread diameter of Wheels	1000 mm
No. of Wheels in each Bogie	2
Total No. of Wheels	8
Max. Wind speed	18 m/s during the movement of Bogie System 30 m/s in Stationary condition of Bogie System
Slope of track existing at site	0.1 m in 663 m existing at site
Rail track	Rail Type MRS-85
Maximum acceleration / deceleration	0.03 m/sec^2

5.1 Bogie System

5.1.1 The Bogie System consists of four nos. of Bogie units located at the four corners of a fabricated Bogie Structure.

5.1.2 Bogie System consists of the following major Components:

a) Spacer Block
b) Interconnecting Structures
c) Yoke
d) Balancer
e) Hinge pin
f) Axle
g) Wheels
h) Maintenance Platform
i) Hydraulic Jacking System

5.1.3 The Load acting on each of the four Bogie units shall be transferred to a set of two wheels by providing a Balancer System.

5.1.4 There shall be four Spacer Blocks provided on the Bogie System and these Spacer Blocks shall be interconnected by means of Interconnecting Structures. Provision shall be made inside the Spacer blocks for mounting of the MLP Lifting Jacks.

5.1.5 The Spacer Block shall be connected to the Yoke and this Yoke shall be in turn connected to the Balancer through a Hinge Pin.

5.1.6 A suitable bearing arrangement shall be provided between the Spacer Block and the Yoke so that the Balancer and the Yoke system along with the two wheels can swivel about the Bogie centerline. This freedom of swiveling motion shall be provided so that the wheels can swivel when the Bogie passes over the curved track.

5.1.7 The Wheels of the Bogie shall be double flanged.

5.1.8 The Interconnecting Structures are connected through Cross Beams / Connecting Beams. Provision shall be made on the Front and Rear end of the Bogie for mounting of Towing Hitches at appropriate locations on Hauler interface structure. The Trailer Hitch will be connected to the Hauler by means of a Tow bar which will be supplied by the Hauler manufacturer.

5.1.9 A Maintenance platform shall be provided on the two sides of the Bogie structure. The access to the Maintenance Platform shall be provided from the sides of the Bogie. Also, provision shall be made on the Maintenance platform for the mounting of the following systems:

a) Hydraulic Power Pack for the MLP lifting Jacks
b) Other equipment to be finalised during erection of Bogie System

5.1.10 The specification of the hydraulic jacks for lifting the MLP with Launch vehicle is given below :

- Jacks and power pack shall be of imported and reputed make. The jacks are located one at each corner, as part of bogie.
- Capacity of hydraulic jack: 300 t X 4 no's
- Saddle: Maximum diameter 300 mm, swiveling type with anti-skid top surface.
- Hose connection: From power pack to the jacks, hoses of high pressure thermoplastic type of suitable length shall be provided. The end connections shall be of QC/DC type with male connection on the jacks and power pack end.
- Size of cylinder: Maximum of 400 mm OD, size of the ram, operating pressure can be suitably designed to accommodate the overall size as given above. Test pressure shall be 1.5 times the design working pressure.
- Rate of lift or lowering under load: 10 mm/min. All the 4 jacks shall be synchronized to operate simultaneously.
- Outside surface of ram and inner surface of cylinder shall be honed and hard chrome plated.
- The seals should be reliable and everlasting type.
- The locknut on the ram shall be designed to take care of the full load and overload.
- The inlet valve to the jack shall be pilot operated type to take care of hose failure.
- One pressure gauge has to be fixed at the jack to monitor the cylinder pressure.
- The jack shall be mounted on a suitable trolley for easy manoeuvrability inside the wheel bogie.
- The hydraulic oil used shall be fire retardant.

5.1.11 The specifications of the hydraulic power pack used to drive the hydraulic jacks are given below:

- Two power packs shall be interconnected and each shall contain a pumping unit with hydraulic high pressure radial plunger type piston pump operated by flame proof electric motor. Each powerpack shall be capable of lifting 600t (MLP + launch vehicle).
- Split flow piston pump with two identical outlets shall be preferred.
- The oil tank shall have an oil level indicator, oil cum air breather, return line filter, drain plug etc.
- The power pack also shall have safety relief valves, non-return valves, oil distributer with flow control and shut off valve with inlet to pump and outlets to four jacks.
- Flame proof DOL starter and cable of suitable length shall be provided.
- Provision for supplying oil to the pilot operated check valve near jacks shall be made.
- The power pack shall have a manual pumping provision with quick interchange facility.
- The manual pump shall operate with effort less than 35kg and shall provide the rated lift in 5 min of pumping.
- The power pack shall supply oil under pressure for operation of pilot operated check valve.

5.1.12 The estimated total weight of various components of Bogie System as well as its material Specifications are listed in Section C1 (Bill of Material) of this Specification.

A brief description of Constructional features of the major components of Bogie system are listed below:

5.2 Spacer Block

5.2.1 There are four Spacer Blocks provided on the Bogie System and these Spacer Blocks are interconnected by means of Interconnecting Structures, Connecting beams and Cross beams.

5.2.2 Raw material shall be tested for its chemical & mechanical properties for at least one sample piece for each batch of heat.

5.2.3 Raw material shall be ultrasonically tested.

5.2.4 Dimensional accuracy required for dimensions without tolerance shall be as per DIN 8570-1987.

5.2.5 Weld joint quality class specification shall be as per DIN 8563-1985, part-3.

5.2.6 Weld joints shall be thermally stress relieved as per DIN 17014:1988 after welding.

5.2.7 Liquid penetration test shall be carried out as per Art.24 code: SE-165, Section-V of ASME on root & final run of all full penetration welds and for all other welds after final run.

5.2.8 100% Magnetic particle test shall be carried out as per Art. 25 code: SE709, section-V of ASME on welds.

5.2.9 UT of welds shall be examined as per Art:2, Section-V of ASME.

5.2.10 Details of dimensional inspection checks to be carried out and surface finish to be achieved shall be submitted to PURCHASER for approval.

5.2.11 Finish machining after heat treatment to be subjected to fluorescent dye penetration test and magnetic particle test as per ASTM A 275.

5.3 Structures of Bogie System

5.3.1 Bogie System consists of Interconnecting structures, Cross beams, Connecting beams and Hauler interface structure. All the above items are of welded construction and are fabricated from plates / rolled sections.

5.3.2 The Interconnecting Structures of Bogie System (having welded construction) are bolted / doweled together with Spacer Blocks, Connecting beams, Cross beams, etc. in the VENDOR’s shop to complete the control assembly of Bogie System.

5.3.3 Each interconnecting structure is a combination of box type girders, which are individually fabricated and then assembled with Spacer Blocks, Connecting beam, Cross beam and subsequently welded at site. Interconnecting structure shall be stress relieved. Stringent tolerances shall be achieved for each module as specified in the drawings.

5.3.4 Provision for mounting of Towing Hitches on Hauler Interface structure shall be made on both Front and Rear end of Bogie System.

5.3.5 Drilling on all the flanges of Connecting beams shall be done in assembled condition with interconnecting structure.

5.3.6 Raw material shall be tested for its chemical & mechanical properties for at least on one sample piece for each batch of heat for each component.

5.3.7 Raw material shall be ultrasonically tested.

5.3.8 Weld joint quality class specification shall be as per DIN 8563-1985, part-3.

5.3.9 Weld joints shall be thermally stress relieved as per DIN 17014:1988 after welding.

5.3.10 Liquid penetration test shall be carried out as per Art.24 code: SE-165, Section-V of ASME on root & final run of all full penetration welds and for all other welds after final run.

5.3.11 100% Magnetic particle test shall be carried out as per Art. 25 code: SE709, section-V of ASME on welds.

5.3.12 UT of welds shall be examined as per Art: 2, Section-V of ASME.

5.3.13 Details of dimensional inspection checks to be carried out and surface finish to be achieved shall be submitted to PURCHASER for approval.

5.3.14 Finish machining after heat treatment to be subjected to fluorescent dye penetration test and magnetic particle test as per ASTM A 275.

5.4 Yoke

5.4.1 Four Nos. of Yokes are required for the Bogie System.

5.4.2 Raw material shall be tested for its chemical & mechanical properties for at least on one sample piece for each batch of heat.

5.4.3 Raw material shall be ultrasonically tested.

5.4.4 Weld joint quality class specification shall be as per DIN 8563-1985, part-3.

5.4.5 Weld joints shall be thermally stress relieved as per DIN 17014:1988 after welding.

5.4.6 Liquid penetration test shall be carried out as per Art.24 code:SE-165, Section-V of ASME on root & final run of all full penetration welds and for all other welds after final run.

5.4.7 100% Magnetic particle test shall be carried out as per Art. 25 code: SE709, section-V of ASME on welds.

5.4.8 UT of welds shall be examined as per Art: 2, Section-V of ASME.

5.4.9 Details of dimensional inspection checks to be carried out and surface finish to be achieved shall be submitted to PURCHASER for approval.

5.4.10 Finish machining after heat treatment shall be subjected to fluorescent dye penetration test and magnetic particle test as per ASTM A 275.

5.5 Balancer

5.5.1 Four Nos. of Balancers are required for the Bogie System.

5.5.2 Raw material shall be tested for its chemical & mechanical properties for at least on one sample piece for each batch of heat.

5.5.3 Raw material shall be ultrasonically tested.

5.5.4 Dimensional accuracy required for dimensions without tolerance shall be as per DIN 8570-1987.

5.5.5 Weld joint quality class specification shall be as per DIN 8563-1985, part-3.

5.5.6 Weld Joints shall be thermally stress relieved as per DIN 17014:1988 after welding.

5.5.7 Liquid penetration test shall be carried out as per Art.24 code:SE-165, Section-V of ASME on root & final run of all full penetration welds and for all other welds after final run.

5.5.8 100% Magnetic particle test shall be carried out as per Art. 25 code: SE709, section-V of ASME on welds.

5.5.9 UT of welds shall be examined as per Art:2, Section-V of ASME.

5.5.10 Details of dimensional inspection checks to be carried out and surface finish to be achieved shall be submitted to PURCHASER for approval.

5.5.11 Finish machining after heat treatment shall be subjected to fluorescent dye penetration test and magnetic particle test as per ASTM A 275.

5.6 Hinge Pin

5.6.1 Four Nos. of Hinge pins are required for Bogie System.

5.6.2 Raw material shall be tested for its chemical & mechanical properties for at least on one sample piece for each batch of heat.

5.6.3 Material shall be forged by open hammer / press forging process. Forged item shall have grain structure of 5 to 7 as per ASTM standard and also shall have minimum grain reduction of 5.

5.6.4 Material shall be heat treated which includes normalising, quenching, tempering and flame hardening. Details of Time-temperature graph for heat treatment and the cooling medium employed for the treatment shall be submitted.

5.6.5 Details of dimensional inspection checks, surface finish and Hardness (Initial and final) shall be submitted. Finish machining after heat treatment shall be subjected to Fluorescent Dye Penetration Test and Magnetic Particle Test as per ASTM-A-275. Also, ultrasonically testing as per ASTM-A-388 to be carried out and acceptance criteria to be followed as per ASTM-A-203.

5.7 Axles

5.7.1 Eight Nos. of Axles are required for Bogie System.

5.7.2 Raw material shall be tested for its chemical & mechanical properties for at least on one sample piece for each batch of heat.

5.7.3 Axle shall be forged by open hammer / press forging process. Forged item shall have grain structure of 5 to 7 as per ASTM standard and also shall have minimum grain reduction of 5.

5.7.4 Axle shall be heat treated to achieve mechanical properties as specified in the drawings. Details of durations at temperature and cooling medium employed for the treatment to be submitted. (Time-temp graph to be furnished).

5.7.5 Details of dimensional inspection checks, surface finish and Hardness (Initial and final) to be submitted. Finish machining after heat treatment shall be subjected to Fluorescent Dye Penetration Test and Magnetic Particle Test as per ASTM-A-275. Also ultrasonically testing as per ASTM-A-388 to be carried out and acceptance criteria to be followed as per ASTM-A-203.

5.8 Wheels

5.8.1 Eleven Nos. (11) of Wheels are required for the Wheel Bogie. 8 shall be fitted to the bogie, 2 are spare and 1 for destruct testing.

5.8.2 Wheel shall be procured from M/s Valdunes, France.

5.8.3 Wheels shall have a diameter of 1000 mm and double flanged. The overall diameter, thickness and bore diameters shall be as per the dimensions indicated in the enclosed sketch of the wheel.

5.8.4 Matching rail: 171-pounds/yard flat rail hardened to 321-388 BHN. Size: MRS 85. The tread width and fillet radii should be suitable for the same.

5.8.5 Bogie system will be travelling in straight track and curved track (of radius R260m) as well.

5.8.6 The wheel shall be capable of withstanding a Vertical load capacity of 100 t (minimum) and Lateral load capacity on flanges of 20t (minimum).

5.8.7 The wheels are fitted to the dead axle of bogie using two number of single row taper roller bearings as per the drawings.

5.8.8 The static load (When wheels are stationary on rails) will be acting on the wheels for 90 cumulative days in a year. The dynamic load (when wheels are moving on rail) will be acting on wheels for 200 cumulative hours in a year. The maximum rpm of the wheel is 5.

5.8.9 Service life expectancy of the wheel under the above given loading conditions shall not be less than 25 years (i.e) 0.9 million cycles of loading for the service life of 25 years. The wheels are expected to work in a high humid conditions (up to 98% RH), saline atmosphere (sea coast) and environmental temperature range of 8 degree C to 50 degree C.

5.8.10 Material for the wheels shall be 42CrMo5-04 to meet the loading conditions.

5.8.11 The manufacturing process shall include forging from ingot, clean vacuum degassing, normalization, machining, heat treatment (water quenching of tread and tempering) and final machining.

5.8.12 The contractor shall make a sample wheel exactly as per the applicable manufacturing process. Destructive test on one wheel shall be carried out so as to verify the load capacity of the Wheel at SUPPLIER'S shop in the presence of ISRO / TPIA.

5.8.13 The wheel shall be made from 42CrMo5-04 steel to meet the loading conditions. It shall be rim quenched and the hardness shall decrease from rim to hub. Hardness shall be decided based on the loads. (More than 50 Rc / 480 HB till a depth of 10mm, more than 47 Rc / 440 HB till 20mm depth and 31Rc / 290 HB at core). If any material other than 42 CrMo5-04 is proposed, supplier shall submit documentary proof detailing the performance of high capacity wheels made out of the proposed wheel material.

5.8.14 The sample wheel shall be subjected to static load test for 150% of vertical load (Fy) and lateral load (Fx, across track) both acting simultaneously. The load tests shall be conducted for 3 different positions of wheel i.e. 120 degrees apart.

5.8.15 Dye-penetrant, magnetic particle test and ultrasonic tests shall be carried out on the sample wheel both before and after load tests. The wheel should not develop any crack after the application of test loads.

5.8.16 All Wheels shall be ultrasonically tested to meet the acceptance criteria as per ASTM A 203. The wheel shall have no regular and isolated discontinuities greater than a reflection represented by a 6 mm diameter flat bottomed hole by ultrasonic testing. Also no extensive and or grouped discontinuities greater than a reflection represented by a 4 mm diameter flat bottomed hole shall be acceptable. Ultrasonic testing shall be carried out on one side of the wheel and on tread.

5.8.17 Residual stresses shall be measured using ultrasonic method on the tread region (rim portion) of the sample wheel at both 0 degree and 90 degree locations (along and perpendicular to tread surface, at least at 4 locations) to confirm the stresses are compressive.

5.8.18 During the processing of sample wheel, test samples shall be taken as per ASTM-A 370 and ASTM-A 266 and tests shall be carried out for chemical composition and mechanical properties to demonstrate that the specified parameters are achieved.

5.8.19 One quarter of the sample wheel shall be wire cut (spark erosion method) or Oxycut, then saw-cut in order to remove thermally affected area due to oxycutting or by any other suitable method. On the cut wheel, tests like hardness profile measurements across the wheel and along the tread surface, inclusion rate measurements as per ASTM-E 45(microscopic methods) using JK chart (method-A), macro and micro structural analysis to find out grain reduction, grain size and grain orientation as per relevant standards like ASTM-E 112 and acceptance level as per section-7 of ASTM-A 321, etc. to demonstrate achieving of design parameters. It is preferred that the inclusion rating of type A, B, C & D shall be restricted to 1.5 (thin) and 1 (thick).

5.8.20 The percentage of Retained austenite in the hardened surface of the sample wheel shall be measured and shall be kept as minimum as possible.

5.8.21 Test results, inspection reports and manufacturing process followed for the sample wheel shall be submitted to the purchaser for review and clearance. Photographs of test setup, cut wheel, microstructure etc. shall form part of the records to be submitted to the purchaser. The report shall clearly bring out conformance of specified parameters for the wheels.

5.8.22 Wheels shall be subjected to Magnetic Particle Test for surface flaw detection.

5.8.23 The SUPPLIER shall submit the procedure to be followed for carrying out forging, heat treatment, machining and testing of the wheel to the PURCHASER for approval.

5.8.24 After successfully manufacturing the sample wheel and demonstrating the various parameters of the wheel as per the requirements, the contractor can manufacture the ordered quantity of the wheels. The contractor should exactly follow the complete manufacturing process, which was followed for the successfully tested wheel.

5.8.25 The total number of wheels that are to be supplied is 10 in addition to the sample cut wheel. The wheels shall be supplied in finish-machined condition as per dimensions and tolerances given in the sketch.

5.8.26 The contractor shall engage M/s Lloyds as third party inspection agency for the inspection of the wheels including sample wheel at various stages of manufacturing and testing.

5.8.27 Every heat shall be certified by the third party inspection agency for its chemical and mechanical properties by taking at least one sample for each heat.

5.8.28 Specimen level fatigue test as per ASTM-E-466-82 shall be carried out for demonstrating the fatigue life of the selected material.

5.8.29 All the forgings shall be subjected to magnetic particle and Ultrasonic Testing as per ASTM-A 388.Tests shall be carried out at the following stages:

a) After forging: Ultrasonic testing

b) After heat treatment: Dye penetrant test

c) Magnetic particle inspection at the final stage

The wheels shall have no regular and isolated discontinuities greater than a reflection represented by a 6 mm diameter flat bottomed hole by ultrasonic testing. Also no extensive and or grouped discontinuities greater than a reflection represented by a 4 mm diameter flat bottomed hole shall be acceptable. Ultrasonic testing shall be carried out on one side of the wheel and on tread.

5.8.30 For all types of tests such as chemical composition, heat analysis, product analysis, tensile strength, yield strength, elongation, number of test samples, location of test samples, etc shall be as per ASTM-A 370 and ASTM-A 266. Suitable provisions for extracting specified test specimens shall be planned for each individual item as per relevant standards.

5.8.31 To ensure consistent and reproducible heat treatment for the wheels as well as test specimens that represent them, use and control of heat cycle simulation procedure as per applicable standard.

5.8.32 Contractor shall provide all inspection/test certificates for all wheels.

5.8.33 Hardness tests for all the wheels on the tread surfaces and other locations shall be carried out to demonstrate achieving the required values as per the specifications. Dimensional inspection also shall be carried out.

5.8.34 The contractor shall provide quality assurance plan (for all the wheels) that is to be followed from raw material to finished wheels. Traceability from the raw material to the finished component should be possible for all the wheels.

5.8.35 Purchaser’s representatives shall be allowed to inspect the wheel forgings at any stage of manufacturing and testing.

5.8.36 All the finished wheels shall be properly coated with zinc primer and polyurethane top coat (RAL 3016) and packed properly for sea transportation.

5.9 Bearings:

5.9.1 Inspection reports and test certificates for the supplied bearings shall be submitted along with supplies

5.9.2 Bearings shall be guaranteed for a period of 12 months from the date of acceptance of the bearings at purchaser's site or 18 months from the date of supply.

5.10 Maintenance platform:

Maintenance platform located on two side of Bogie System shall be fabricated at site.

5.11 Hydraulic Jacking System: Refer section C2 of this specifications for the details of hydraulic jacking system

6.0 INTERFACING SYSTEM FOR BOGIE SYSTEM:

1. MOBILE LAUNCH PEDESTAL (MLP)

The Launch vehicle will be assembled on MLP. In Integration building, the MLP is positioned & anchored to Ground Anchors and Launch vehicle is assembled on it. When the MLP with Launch Vehicle in assembled condition is to be transported to launch pad, the Bogie System is brought under the MLP. The four MLP lifting jacks mounted on the Bogie System lift the "MLP with Launch Vehicle". The Bearing plates located between the MLP and Ground Anchors are removed and then the MLP lifting jacks are lowered. Subsequently, at the interface of MLP with Bogie System, Fasteners shall be assembled between Bogie System and MLP so that the MLP & Launch Vehicle rests on the Bogie System for transportation of the Launch vehicle to launch pad. The MLP and the fasteners (required to be mounted at the Bogie-MLP interface) will be provided by the PURCHASER. Interfaces on the Bogie System for these items shall be provided by the CONTRACTOR.

2. HAULER TOWING HITCH

The Bogie System will be connected to the Hauler by means of Tow bar and Towing Hitches. The towing Hitches will be provided by the PURCHASER. Interfaces for mounting of Towing Hitches shall be provided by the CONTRACTOR on both Front and Rear end of the Bogie System for connection of Tow bar from the Hauler.

3. MLP LIFTING JACKS WITH HYDRAULIC POWERPACK

Four nos. of 300t capacity Double Acting Hydraulic Jacks are used for lifting MLP on the Wheel Bogie. The jacks are located inside the four Spacer Blocks of the Wheel Bogie. Suitable insert plates shall be provided by CONTRACTOR for positioning and operation of these jacks. All four (4) jacks are connected by means of interconnecting piping to the Hydraulic Powerpack located on the Wheel Bogie structure. Installing interconnecting piping is in scope of CONTRACTOR only.

7.0 BOUGHT OUT ITEMS FOR BOGIE SYSTEM

All bought out items shall be procured and assembled with Bogie System. The Preliminary Technical Specification of various Bought out items of Bogie System are listed below:

Sl. No.	Components	Specification
1.	Wheel (with Double flange)	Diameter : 1000 mm Vertical load Capacity : 100 T (minimum) Lateral Load Capacity : 20 T (minimum)
2.	Single Row Taper Roller Bearing	Type : EE224115/ 224204 Outer Diameter : 520.70 mm Inner Diameter : 292.10 mm Width : 107.95 mm Make : TIMKEN
3.	Spherical roller bearing	Type : 23076 CC/W33 Outer Diameter : 560 mm Inner Diameter : 380 mm Width : 135 mm Make : SKF
4.	Spherical roller bearing	Type : 23088 CA/W33 Outer Diameter : 650 mm Inner Diameter : 440 mm Width : 157 mm Make : SKF
5.	Spherical roller thrust bearing	Type : 29352E Outer Diameter : 420 mm Inner Diameter : 260 mm Width : 95 mm Make : SKF
6.	Rail Clamp	Model No.: VZM -2 (with Floating Housing type SG-VZM-2) (Rail Clamp shall be suitable for mounting on Rail type MRS 85) Make : RÖMER Födertechnik Gmbh
7.	Hydraulic jack and power pack system	Capacity : 300 T Stroke : 150 mm Type : Double acting Hydraulic type Make : Euro Press Pack
8.	3 Phase flame proof distribution panel with LDB, PDB, UPS, hydraulic jack supply incoming with outgoings	FCG Flame proof control pvt ltd, baliga, Stahl

9.	LED flame proof light fittings	FCG Flame proof control pvt ltd, baliga, Stahl
10.	Flame proof warning light fittings	FCG Flame proof control pvt ltd, baliga, Stahl
11.	Flame proof Annunciator	FCG Flame proof control pvt ltd, baliga, Stahl
12.	Flame proof sockets Single phase	FCG Flame proof control pvt ltd, baliga, Stahl
13.	Flame proof sockets 3 phase	FCG Flame proof control pvt ltd, baliga, Stahl
14.	PLC Panel including software and hardware.	PLC system: Siemens/Schiender
15.	Instruments required for measurement of strain, speed, vibration, acceleration, position etc. along with wiring for power and communication	P&F, Hubbner, liende & liende B&K , Endevco, PCB Solatron
16.	Miscellaneous items (general wiring items, armoured Cu power cables, installation accessories, cable trays & accessories etc.)	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard PATNY / INDIANA / PROFAB / ASIAN / GLOBE
17.	MCBs / ELMCB/RCBOs	Legrand, L&T, Siemens, ABB, Schneider
18.	GI Conduits & accessories	Toshniwal, Steel kraft, Vimco, TATA, Jindal, Adharsa, JPC

8.0 MANUFACTURING, ASSEMBLY, TESTING AND INSPECTION

8.1 GENERAL INSTRUCTIONS

The general instructions for fabrication are specified in the subsequent clauses.

8.1.1 All rolled steel sections before being used for fabrication shall be clean, free from bends, twists, etc. and straight within tolerances specified by IS: 1852 – 1985. If straightening or flattening is necessary, it shall be done by methods that will not injure the material. Long plates shall be straightened by passing through a mandrel or levelling rolls and structural shapes by the use of mechanical or hydraulic bar/section straightening machines. Heating or forging shall not be resorted to without the prior approval of the PURCHASER in writing. In case of site fabrication, CONTRACTOR shall obtain PURCHASER's approval in writing on the straightening method proposed to be adopted before commencing the work.

8.1.2 Welding shall be performed as per IS: 9595.

8.1.3 All welding shall be carried out by qualified and approved welders in accordance to ASME Sec IX.

8.1.4 Unless otherwise specified on drawings, tolerances for fabrication shall be as per ISO: 13920.

8.1.5 Edge preparation shall be carried out for all plates before welding. For butt-weld joints, edge preparation shall be preferably done by machining and may be done by mechanically controlled gas cutting machine. Sub surfaces shall be ground, cleaned and inspected before fitting / welding.

8.1.6 Unless otherwise specified on drawings, all butt welds shall be full penetration welds.

8.1.7 Unless otherwise specified on drawings, all fillet welds shall be 50% of the minimum plate thickness and shall be on both sides of the plate. Also, the weld shall be continuous.

8.1.8 Welding sequence shall be such that the distortion and residual stresses are minimised. All welds shall be deposited in proper sequence so as to balance the applied heat as far as possible. (A wandering sequence shall be used whenever necessary).

8.1.9 The procedure to be followed by CONTRACTOR for all weld repairs shall be subject to approval by the PURCHASER.

8.1.10 Stress relieving shall be carried out for all fabricated components prior to its machining.

8.1.11 All sharp corners of machined / fabricated items shall be smoothened by de-burring, hand grinding, chipping and filing.

8.1.12 Fabricator employed at site shall have adequate machining, welding, metrology and portable NDT facilities.

8.1.13 All fabrication work undertaken in parts shall bear distinct match marking to facilitate further identification and erection.

8.1.14 During manufacturing, assembly, erection and commissioning, bolt tightening shall be carried out using torque wrench / impact wrench to ensure required tightening / tension in the bolts.

8.2 MANUFACTURING INSTRUCTION

8.2.1 The VENDOR shall arrange to procure the raw materials, manufacture, assemble, test and inspect the Bogie System at his shop and site as stated in the subsequent clauses.

8.2.2 VENDOR shall make necessary arrangements for carrying out various tests at his shop. After completion of testing of Control assembly at VENDOR's shop, the Bogie System shall be dismantled with proper match marking and various individual components shall be despatched and assembled at site.

8.2.3 The four Interconnecting Structures shall be bolted / dowelled with Spacer Blocks, Connecting beams, Cross beams, etc. and subsequently welded. The post weld heat treatment of weld joints shall be carried out in-situ at site.

8.2.4 The VENDOR shall furnish welding procedure and the method of carrying out post weld heat treatment for various components of Bogie System to

the PURCHASER for his review and approval. Also, Preliminary welding procedure and methods for carrying out post weld heat treatment shall be enclosed along with the BID.

8.2.5 All Free issue items supplied by PURCHASER for shop as well as site assembly shall be assembled and tested by the CONTRACTOR.

8.2.6 VENDOR shall make necessary arrangements for carrying out various tests at his shop. After approval of various tests by PURCHASER, the equipment shall be dismantled with proper match marking into transportable modules.

8.2.7 The records of all the tests carried out at VENDOR's shop shall be maintained and furnished to the PURCHASER for reference.

8.2.8 VENDOR shall submit schematic diagram envisaged for assembly and testing of Bogie System.

8.2.9 WPS for welding of components like Bogie structures, Spacer Blocks, Balancers, Yokes, etc shall be furnished in his BID. WPS for Bogie Interconnecting Structure shall also be taking into account the welding of dissimilar materials.

8.2.10 VENDOR shall submit fabrication procedure / fabrication plan / shop welding plan of Bogie Structures, Yokes, Spacer Blocks, Balancers, etc. indicating stages of carrying out UT or RT (as per drawing), considering accessibility of weld joints.

8.2.11 Process sheet of various manufacturing activities shall indicate Quality milestones for carrying out various Quality Control activities before start of next manufacturing activity.

8.3 MACHINING

a) Yokes & Balancers of the Bogie shall be machined separately maintaining the geometrical tolerance and then taken up for assembly.

b) In-line boring of the hubs in the Yoke (for mounting of Hinge Pins) is to be ensured with reference to their Top surface.

c) While machining Spacer Blocks, some machining stock is to be left over on the top and bottom surface, which shall be finally machined after welding with the Bogie Structure in modules, maintaining geometrical tolerances as specified in the drawings. Complete Bogie Structure shall be assembled, bolted and dowelled maintaining top surface of Spacer Blocks in one level within tolerance as specified in the drawings by selecting appropriate assembly methodology.

8.4 Assembly of Sub-systems at CONTRACTOR'S Shop

8.4.1 Instructions For Bearing Fitting

Before the starting of mounting a bearing, ensure that the shaft and bearing housing are within the stipulated tolerances. Ensure that the

contact between bearing OD and the housing bore is minimum 80%.
Bearing for fitting shall be heated in oil or induction heating shall be carried out. The bearing shall be fully immersed in the heated up oil bath. Transformer oil shall be used as heating medium. The container shall be cleaned and designed to ensure that the bearing does not come in direct contact with the heated surface. Bearing shall be heated to above 80-90° C. The expansion of bearing bore shall be ascertained using gauge for proper fitting of the bearing on the shaft. The bearing shall be held properly against the shaft shoulder until it cools and grips the seating.
Protection of bearing after mounting: when the bearing is mounted, seal must not be left uncovered as foreign particles may get into the bearing. The bearing shall be properly covered with grease paper or 0.5mm thick polythene paper.

8.4.2 Assembly Sequence at CONTRACTOR's Shop

The items / components / sub-assemblies shall be erected / mounted in the following sequence. However the sequence may be altered based on site condition and local constraints, which cannot be envisaged now.

1. Align and grout Rail Track of 50 meters length for erection of Bogie System at shop for control assembly.
2. Place four Bogies (consisting of the assembly of wheel, Axle, balancers, Yokes, Spacer Block) on Rail Tracks using mobile crane, one after the other with proper support.
3. Align four bogies on Rail Track as per the drawings positioning them to 7.5 m x 7.5 m square.
4. Assemble Interconnecting Structures to their respective Bogies using mobile crane.
5. Align Bogie Interconnecting Structure using temporary supports and inspect all the dimensions and then fasten the bolts between Spacer Block and Interconnecting Structure. (Spacer Block and Interconnecting structure shall be rigidly aligned to each other by using temporary lug supports (cleats) which are to be welded on all sub-systems as required).
6. Test run the Bogie System on track using winch mechanism.
7. Mark all the match marking points on the sub-systems of the Bogie System.
8. Dismantle all the sub-systems after inspection / testing and despatch to site for erection.

The BIDDER shall furnish the assembly testing program / scheme with the offer.

9.0 ERECTION, TESTING & COMMISSIONING

9.1 Erection of Bogie System at Site

9.1.1 Pre-requisites

Rail track for at least 200 m length fully aligned and ground to take up erection of the Bogie System assembly on Tracks at site shall be provided by the PURCHASER.

9.1.2 Transportation and Temporary Placement

Bogies and structural segments shall be loaded on a trailer at main stores, transported from stores to erection site and unloaded at a place designated for the purpose of erection.

9.1.3 Basic Methodology and Scaffolding / Lifting Arrangements

The basic methodology lies in the understanding of the CONTRACTOR to devise temporary means of material lifting and supporting to align segments, bolting / welding & stress relieving as per drawing to complete the Bogie System assembly.

For installation of Bogie System, one or more mobile cranes of adequate capacity shall be deployed at site by the CONTRACTOR. The support structure required for installation shall be fabricated at site for proper alignment of different segments.

9.1.4 Installation Procedure / Erection Sequence

1) The equipment delivered at site shall be inspected and checked as per the packing list for ensuring availability of complete list of components / materials.

2) All Sub-assemblies / Components shall be cleaned and the corrosion preventing coating, if applied shall be removed from surface of the components. The components which are delivered in dismantled condition shall be cleaned prior to their assembly.

3) The CONTRACTOR shall submit documents depicting Fabrication and Erection Procedure at site, Alignment Sequence, details of Trial / Test Runs to be conducted at site without and with MLP mounted on Bogie System, based on the guidelines indicated in this document.

4) The Centrelines & benchmarks shall be checked and established in suitable place for easy reference.

5) The sub-assemblies shall be dismantled and all the antifriction bearings, if necessary, shall be thoroughly re-visited and lubricated prior to assembly.

6) The items / components / sub-assemblies shall be erected / mounted in the following sequence. However, the sequence may be altered due to site condition and local constraints, which cannot be envisaged now.

a) The four Bogies (consisting of the assembly of Wheel, Axle, Balancers, Yokes, etc.) are to be mounted on the existing Rail Track at site by using Mobile Crane. The Bogies are to be positioned at the corners of a 7.5 m x 7.5m square within required tolerance specified on the drawings.

b) The Interconnecting Structures are to be assembled on the Bogie using Mobile crane and are to be positioned suitably on temporary supports.

c) The Cross beams / Connecting beams, Interconnecting Structures & Spacer Blocks are to be bolted and subsequently welded in position so as to create the integral Bogie structure.

d) The Maintenance platform located on the two sides of the Bogie is to be fabricated and erected on the Bogie structure.

e) The Hydraulic Power Pack and the MLP lifting Jacks are to be mounted on the Bogie and connected by means of interconnecting piping.

f) The Electrical panels and cables are to be mounted on the Bogie System.

g) The Parking Brakes are to be mounted on the Bogie System.

h) The Trailer Hitches are to be mounted at the Front and Rear end of the Bogie System.

i) Test runs the Bogie System on both straight and curved track using Hauler system shall be carried out.

j) Check operation of all the four Nos. of 300 T capacity Hydraulic Jacks.

9.2 TESTING

9.2.1 Testing of Bogie System at CONTRACTOR's Shop

1) Each major sub-assembly shall be inspected and approved for final assembly by ISRO / TPIA before being mounted on Bogie System.

2) The following tests shall be carried out at VENDOR's works in presence of ISRO / TPIA:

a) Levelling and alignment of temporary Rail track erected at shop.

b) Squareness and centre to centre distances at the four Bogies.

c) Distance of top surface of Spacer Block from the Rail top.

d) All control dimensions of the Bogie System assembly.

e) Smooth To and Fro Movement of complete Bogie system through a distance of 10 m for at least 5 times. Movement of Bogie System shall be checked using suitable Winch mechanism.

9.2.2 Testing of Bogie System at site

a) Squareness and centre to centre distance of individual Bogies.
b) Distance of top surface of the Spacer Blocks from Rail top (without MLP).
c) Smooth movement of complete Bogie System (without MLP) on Rail track using Hauler.
d) Checking the movement of Bogie System (without MLP) on a Curved Track.
e) Checking the operation of four MLP Lifting Jacks.
f) Checking the operation of Parking Brakes installed on the Bogie System.
g) Checking the assembly of MLP on Bogie.
h) Load testing of Bogie System with MLP (with dummy load to simulate vehicle weight).
i) Checking the Lifting of MLP (with dummy load for the Vehicle weight) by the Hydraulic Jacks.
j) Test run of Bogie System along with MLP (with Dummy load for vehicle weight) at rated speed using Hauler on straight Track.
k) Testing of the movement of the Bogie System along with MLP (with Dummy load to simulate vehicle load) using Hauler on curved Track.
l) Testing of the transfer of Support of MLP from Bogie to Anchor legs and the withdrawal of the Bogie System using Hauler.

9.3 Commissioning (functional checks with MLP)

After complete testing & evaluation of Systems, Commissioning activities will be carried out by ISRO. During commissioning trials, CONTRACTOR's responsibility is limited to participation in the trials by deputing his representative to ensure that the installation of Bogie System shall perform to the expected level as per the Specification, standards and procedures stipulated in the CONTRACT. The CONTRACTOR shall ensure to attend to the defects noticed if any and rectify the same for future continuation of work during the trails.

The commissioning activity includes the following:

1. Load testing of Bogie System with MLP weighing 250 Tons. Strain to be measured and extrapolated to 600 Tons.
2. Test run of Bogie System with MLP on straight and curved track using

Hauler, accurate positioning of MLP at parking locations, transferring the MLP from Bogie Systems to Anchors and withdrawal of Bogie System.

9.4 Accuracy Requirements To Be Fulfilled By Bogie Structure

Accuracy requirements to be fulfilled by Bogie structure during control assembly at shop and after erection at site are as follows:

9.4.1 Centre to centre distance between any two adjacent Bogies shall be within **$7500^{\pm 1}$**mm**.**

9.4.2 Squareness of the Bogie system (i.e. The difference in the two Diagonal Centre to Centre distances of the Bogies) shall be within **2 mm.**

9.4.3 Distance from **top** of Rail to top surface of Bogie System shall be within **$2040^{\pm 0.5}$**mm**.**

10.0 Minor Fabrication / Improvement works in Bogie System

10.1 Minor fabrication / improvement works on Bogie System to an extent of approximately **5 Tons** is required to be carried out at site the details of which cannot be envisaged now. Details of minor fabrication / improvement works will be given during the erection of Bogie System at site.

10.2 Procurement of raw material like plates, rolled sections and pipes for minor fabrication works / improvement works on Bogie System shall be arranged by the VENDOR.

10.3 The material has to be utilised for modification of the Maintenance platforms of the Bogie System and for providing Roof over some of the equipment like hydraulic power packs, etc. Actual work will be decided after completion of the work specified in drawings and based on the actual site condition.

10.4 Payment for the Minor Fabrication / Improvement works will be made on pro-rata basis on the actual Tonnage of material used for fabrication.

11.0 Codes and Standards

11.1 All equipment, system and services covered under this Specification shall comply with all currently applicable statutes, regulations and safety codes. Nothing in this Specification shall be construed to relieve the BIDDER of his responsibility.

11.2 The standards not indicated in the Specification are also acceptable, if they are established to be equal or superior to the standards indicated in the Specification.

11.3 The metric units / SI units shall be used in all data / drawings submitted against this Tender.

11.4 The BIDDER shall furnish the English translations of all standards to which the equipment and systems offered are conforming to, as and when required by the PURCHASER.

11.5 In the event of any conflict between the Codes and the Standards referred to elsewhere in the Specification and the requirements of this Specification, the more stringent of the two shall govern.

11.6 The latest issue of IS codes prevailing at the time of submission of final offer shall be applicable. However, if there are any revisions during the execution of the CONTRACT, the same shall be applicable and the cost implication, if any, shall be mutually discussed

11.7 The Bogie shall comply with the requirements of the following codes and standards:

Steel for general structural purposes	IS 2062
Rolled Sections and Special sections	IS 808, IS 1161, IS 1173, IS 1252, IS 1730, IS 1731, IS 1732, IS 1863, IS 1864, IS 2314
Interconnecting Structure, Balancer, Spacer block, Yoke, Bearing retainer, etc.	DIN 8563-1985 part-3 DIN 17014:1988 ASME SA 517 S690 QL as per EN 100025 Art 24, Code:SE-165, Section-V of ASME. Art 24, Code:SE-709, Section-V of ASME. Art 5, Code:SE-165, Section-V of ASME. ASTM-A-275
Hinge Pins, Axles , etc.	ASTM-A370-Methods and definitions for mechanical testing of steel products. ASTM-A388- Practice for ultrasonic examination of heavy steel forgings. ASTM-A509- Definitions and terms relating to steel forging. ASTM-E30- Methods for chemical

	analysis of steel Cast Iron, Open hearth Iron & wrought Iron. ASTM-E44- Definitions and terms relating to heat treatment of metals. ASTM-A275- Method for magnetic particle examination of steel forgings

12.0 SPECIFIC REQUIREMENTS / INSTRUCTIONS TO BIDDERS

12.1 BIDDER'S OFFER

12.1.1 BIDDER shall carefully study all sections of this Specification and indicate all deviations in the Schedule of Deviations. If no deviations are indicated in the Schedule of Deviations, it will be presumed that the offer conforms in all other respects to the Specification and PURCHASER reserves the right to evaluate the BIDDER. If the BIDDER indicates any Deviations / Comments on the Specification elsewhere in his BID, the same will not be accepted. It is binding on the BIDDER to supply the equipment and systems in conformity with the Specification except for deviations taken in the BID under "Schedule of Deviations" and accepted by the PURCHASER. No extra claims on this account after award of CONTRACT will be entertained by the PURCHASER.

12.1.2 BIDDER shall furnish all the information called for in the various sections of this Specification failing which the bid will be considered incomplete and PURCHASER reserves the right to reject the BID.

12.1.3 BIDDER is advised to quote for the complete scope and partial response will not be entertained. In case of few items which do not directly fall under BIDDER's manufacturing range and / or not available from indigenous source, BIDDER should take the responsibility upon themselves to arrange to procure them and supply to ensure that their offer is complete in all respects.

12.2 All bought out items supplied shall have capacities not less than those stated in this Specification and necessary test certificates shall be furnished in this regard. However, if the BIDDER considers that higher capacity is required to meet guarantee requirements, he should offer the same and substantiate the same by calculations.

12.3 The BIDDER shall specify all the Design modifications which he considers are necessary for him to carry out in order to meet the Guarantee requirements. The details of design modifications proposed to be carried out shall be attached as Annexure to the Schedule of Deviations from Technical Specifications.

12.4 Any items which may not have been specifically mentioned herein but are needed to complete the equipment / system shall also be treated as included and the same shall also be furnished and erected, unless otherwise specifically excluded as indicated.

12.5 All tools and tackles required during various stages of execution of project right from manufacture at shop to the erection and testing at site shall be in the scope of the CONTRACTOR.

12.6 The BIDDER shall quote his prices in the format as indicated in Section-F in the "Schedule of Prices and Delivery" of this Specification. Presentation of prices in any other format is not acceptable.

12.7 BIDDER shall furnish within 15 days of receipt of letter of Intent, a detailed network schedule covering all activities for execution of this CONTRACT.

12.8 The BIDDER shall furnish one complete set of any special maintenance tools required for normal maintenance of equipment. The prices for the same shall be indicated in section-F – Schedule of prices and delivery.

12.9 The prices quoted shall be firm.

13.0 RELIABILITY AND QUALITY ASSURANCE PLAN

13.1 The inspection procedures shall be categorized as follows:

(a) Category A: Stage wise and final inspection including review of documents by Department.

(b) Category B: Stage wise and final inspection including review of documents by the CONTRACTOR. DEPARTMENT shall perform final inspection and review documents.

(c) Category C: Final inspection and review of documents shall be carried out by the CONTRACTOR. DEPARTMENT shall carry out the final review of documents.

13.2 The minimum requirements for ensuring quality at various stages are spelt out below. However, the reliability and quality assurance plan shall be prepared by the VENDOR and shall be reviewed and approved by DEPARTMENT.

13.3 The following are the basic Inspection requirements to be followed upon receipt of raw material:

Review of material test certificates	Category C
UT of plates for thickness greater than 20 mm	Category C

13.4 The following are the minimum in-process tests that shall be carried out:

Welding procedure & welder / welding operator's performance qualification	Category C
100% MT / PT for flame cut edges for plate thickness exceeding 38mm.	Category B
100% PT after back gouging	Category B
100% UT / RT for full penetration welds	Category A

100% MT / PT for full penetration welds after final pass	Category A
100% MT / PT for fillet welds after final pass	Category A
100% MT / PT for fillet welds between tension flanges & webs.	Category A
100% UT for forgings	Category A

13.5 Heat treatment shall be carried out on the following:

For carbon steel plates where thickness exceeds 20 mm.	Category C
All other components as referred to in the drawings.	Category C

13.6 The following are the final inspection / tests that shall be carried out:

Visual and dimensional inspection of components / sub - assembly	Category A
Blue matching for bolted components	Category A
Control assembly of Bogie System at Vendor's shop and testing for Performance requirements	Category A
Complete assembly of Bogie System at site and testing for Performance requirements	Category A

14.0 INSPECTION AND TESTING PROCEDURES AND SCOPE OF INSPECTION

14.1 Raw Material Inspection shall be carried out at the VENDOR's works for compliance of the raw materials to the specified standards.

14.2 Bought out components shall be inspected either at VENDOR's works or at the SUB-CONTRACTOR's premises for compliance with the Specifications.

14.3 Fabricated components shall be inspected at the VENDOR's works for compliance with the component drawings. Sub-Assemblies shall be inspected at the VENDOR's works for compliance with the Sub-Assembly drawings and for performance requirements. Also, full Assembly of the Bogie System shall be inspected at VENDOR's works after shop assembly for compliance with assembly drawings and performance requirements.

14.4 The Third Party Inspection Agency shall report to the PURCHASER technically for all Inspection works and shall meet all the requirements specified by the PURCHASER.

14.5 Full Assembly of the Bogie System shall be inspected at PURCHASER's premises after site assembly for compliance with the Assembly Drawings and Performance requirements.

14.6 After the award of CONTRACT, CONTRACTOR shall prepare detailed Quality Assurance Plan (QAP) for inspection & testing of all subassemblies / components of the Bogie System. The QAP shall be reviewed and approved by the Third Party Inspection Agency and the PURCHASER. Indicative QAPs for Bogie System are enclosed in Section D1 respectively of this Specification.

14.7 The procedure to be followed for testing the accuracy requirements for the top surface of the Bogie System shall be as prepared by the CONTRACTOR and the same shall be submitted to the PURCHASER for review and approval.

14.8 All measuring and testing instruments / equipment required for carrying out all tests at VENDOR's works and at PURCHASER's site shall be provided by the CONTRACTOR.

14.9 CONTRACTOR shall furnish calibration certificates for the instruments to be used for testing at shop and site. The calibration certificates furnished by the CONTRACTOR shall not be more than 12 months old.

15.0 GUARANTEES AND PERFORMANCE REQUIREMENTS

The Bogie System shall perform satisfactorily to meet the Guarantee requirements stated in Section F2 of this Specification to the entire satisfaction of the PURCHASER.

16.0 ACCEPTANCE TEST

16.1 After the entire installation work has been completed, the CONTRACTOR shall make all required adjustments until all Guaranteed Performance requirements are met. All instruments, services required for the above tests shall be furnished by the CONTRACTOR.

16.2 If the stipulated performance requirements are not fulfilled, the CONTRACTOR shall make good the deficiency by providing it in every case, by altering and / or replacing the parts or the whole equipment / system free of charge to the PURCHASER immediately. All rejected equipment shall be removed from the site at CONTRACTOR's expense.

17.0 SURFACE PREPARATION AND PAINTING

The painting of Bogie System shall be carried out as per Section C5 of this Specification as well as the PURCHASER's specific instructions for painting after the Award of CONTRACT.

18.0 TENDER EVALUATION AND PENALTY FACTOR

18.1 TENDER EVALUATION

18.1.1 The BIDDER shall comply with all requirements specified in this Specification.

18.1.2 Deviation from the specifications, if acceptable to the PURCHASER insofar as practicable will be converted to rupee value and added to the Bid price to compensate for the deviation from the Specification. In determining the rupee value of the deviations, the PURCHASER will use the parameters consistent with those specified in the documents and specifications and other information as necessary and available to the PURCHASER.

19.0 DATA TO BE FURNISHED ALONG WITH BID

The BIDDER shall ensure that the following documentation are prepared and submitted to PURCHASER for his review / record.

19.1 Description of the equipment offered along with catalogues, drawings, etc.

19.2 Assembly shop layout drawings with plan for carrying out control assembly on it.

19.3 Details of heat treatment and Stress relief of each components and structures.

19.4 Project execution plan.

19.5 Bar Chart For Supply & Erection Schedule Indicating The Date Of Completion Of Various Activities So As To Complete The Execution Of The Contract Within The Time Frame Stipulated In The Tender Specification.

19.6 Deviations from technical specification and proposed design modifications.

19.7 All annexures of section F duly filled in, signed and sealed

19.8 Write-up on the procedure to be followed for the erection of bogie system.

19.9 Other drawings and documents as specified under various sections of this tender.

19.10 The above list of documents is indicative and not exhaustive. The bidder / contractor shall submit documents as specified in various sections of this specification and also as per the specific instructions of the purchaser.

20.0 DATA TO BE FURNISHED AFTER AWARD OF CONTRACT

20.1 Schedule of Assembly & Detailed drawings and documents to be submitted for review & approval with submission dates.

20.2 Quality Assurance Plan (QAP)

20.3 Bar chart for supply & erection schedule indicating the date of completion of various activities so as to complete execution of the Contract within the time frame stipulated in the LOI / Purchase Order.

20.4 Progress Reports

20.5 Erection, start-up, operation and maintenance manual complete with lubrication schedule etc.

20.6 As-built drawings.

20.7 Quality Assurance documentation compiled for the project.

20.8 Other drawings and documents as specified under various sections of this tender.

20.9 The above list of documents is indicative and not exhaustive. The CONTRACTOR shall submit documents as specified in various sections of this Specification and also as per the specific instructions of the PURCHASER.

21.0 FINAL DOCUMENTS

21.1 CONTRACTOR shall submit the copies of operation and maintenance manuals well before the despatch of the equipment. The manual shall be in sufficient detail with step by step instructions to enable others to Inspect, erect, commission, maintain, dismantle, repair, reassemble and adjust all parts of the equipment. Each manual shall also include a complete set of approved as built drawings together with performance / rating curves / charts of the equipment, maintenance schedule and test certificates wherever applicable.

21.2 CONTRACTOR shall submit all the raw material test certificates, Ultrasonic testing of the raw material, Ultrasonic / radiography test certificates of all necessary welds, Stress relieving Charts, Hardness test certificates and Dimensional inspection reports of individual components

21.3 Quality assurance documentation compiled for the project.

BILL OF MATERIAL FOR BOGIE SYSTEM

DETAILS OF COMPONENTS FOR BOGIE SYSTEM

Sl No.	DESCRIPTION OF COMPONENT	QTY	OVERALL DIMENSIONS (mm)	MATERIAL	APPROX. TOTAL WEIGHT (kg)	HEAT TREATMENT / REMARKS
1	Wheel	11	Ø 1000 (D) x 200 (W)	To be selected by Wheel Manufacturer	9600 + 3600 = 13200	For bogie : 8 Spare: 2 Sample test: 1 Refer Clause 5.8 in Section B
2	Axle	8	As per enclosed drawing	Forged Steel ASTM A668 Class F	2000	
3	Hinge Pin	4	Ø 380 mm, Length 960 mm	Forged Steel ASTM A668 Class F	3440	
4	Spacer Plate for Hinge Pin	8	340 (OD) x 300 (ID) x 30 thk.	Grade E250, Quality BR as per IS:2062	38	
5	Balancer	4	As per enclosed drawing	ASME SA 517 Grade F / S690 QL as per EN 10025	13732	
6	Yoke	4	As per enclosed drawing	Carbon Steel IS 2004, class 2A	6520	
7	Yoke Shaft	4	As per enclosed drawing	Forged Steel ASTM A668 Class F	3884	
8	Bearing Retainer at Wheel	16	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	960	
9	Bearing Cover for Yoke bearings	4	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	360	
10	Single Row Taper Roller Bearing	18	520.700 (OD) x 292.100 (ID) x	Timken part No.EE224115/	683.5	For bogie system : 16

BILL OF MATERIAL FOR BOGIE SYSTEM

Sl No.	DESCRIPTION OF COMPONENT	QTY	OVERALL DIMENSIONS (mm)	MATERIAL	APPROX. TOTAL WEIGHT (kg)	HEAT TREATMENT / REMARKS
			107.95 (W)	224204		Spare: 2
11	Lock Nut for Bearing	8	Tr240 x 4	SKF HM40T	45	
12	Lock washer	8	As per enclosed drawing	SKF MB48	4	
13	Spherical Roller Bearing	5	560 (OD) x 380 (ID) x 135 (W)	SKF 23076 CC/W33	460	For bogie system : 4 Spare: 1
14	Spherical Roller Bearing	5	650 (OD) x 440 (ID) x 157 (W)	SKF 23088 CA/W33	720	For bogie system : 4 Spare: 1
15	Spherical Roller Thrust Bearing	5	420 (OD) x 260 (ID) x 95 (W)	SKF 29352E	196	For bogie system : 4 Spare: 1
16	Lock Nut for Bearing	4	Tr 420 x 5	SKF HM3084	72	
17	Spacer for Yoke Bearings	4	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	184	
18	Bearing retainer for Yoke Bearings	4	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	104	
19	Rail Clamp	2	As per enclosed drawing			
20	Spacer Blocks	4	As per enclosed drawing	ASME SA 517 Grade F / S690 QL as per EN 10025	5831	
21	Interconnecting Structure					

BILL OF MATERIAL FOR BOGIE SYSTEM

Sl No.	DESCRIPTION OF COMPONENT	QTY	OVERALL DIMENSIONS (mm)	MATERIAL	APPROX. TOTAL WEIGHT (kg)	HEAT TREATMENT / REMARKS
21.1	Connecting Beam (Type - I)	2	300 mm Sq. x 6420 (L) x 16 mm thk. (with flange 20 mm thk.)	Grade E250, Quality BR as per IS:2062	1890	
21.2	Connecting Beam (Type - II)	2	300 mm Sq. x 6460 (L) x 16 mm thk. (with flange 20 mm thk.)	Grade E250, Quality BR as per IS:2062	1900	
21.3	Connecting Beam (Type - III)	2	300 mm Sq. x 5450 (L) x 216 mm thk.	Grade E250, Quality BR as per IS:2062	1510	
21.4	Corner Box	4	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	937	
21.5	Covering plate	4	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	1370	
21.6	Stiffener Plates	26	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	440	
22	Maintenance platform and supporting structure					
22.1	Ch. Plate for Platform		Chequered plate, 6 mm thk.	Grade E250, Quality BR as per IS:2062	420	
22.2	Supporting Members		ISMC 75, Total Length 15m	Grade E250, Quality BR as per IS:2062	108	
22.3	Structural Plate		As per enclosed drawing	Grade E250, Quality BR as per IS:2062	1364	
23	Hauler Interface					

BILL OF MATERIAL FOR BOGIE SYSTEM

Sl No.	DESCRIPTION OF COMPONENT	QTY	OVERALL DIMENSIONS (mm)	MATERIAL	APPROX. TOTAL WEIGHT (kg)	HEAT TREATMENT / REMARKS
23.1	Front and Rear box section with inner stiffener	2	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	2680	
23.2	Stiffener Plates	6	As per enclosed drawing	Grade E250, Quality BR as per IS:2062	275	
24	Hydraulic Jack	6	Capacity : 300 T Stroke : 150 mm		1032	4 for bogie system + 2 (spares) Refer Section C2
25	Hydraulic Power pack with hoses	2			200	Refer Section C2
26	Miscellaneous (Bolts, Nuts, Washer, Oil seals, ‘O’ rings etc)				500	
27	3 Phase flame proof distribution panel with LDB, PDB, UPS, hydraulic jack supply incoming with outgoings	1				
28	LED flame proof light fittings	12				
29	Flame proof warning light fittings	8				
30	Flame proof Annunciator	2				
31	Flame proof sockets Single phase	4				

BILL OF MATERIAL FOR BOGIE SYSTEM

Sl No.	DESCRIPTION OF COMPONENT	QTY	OVERALL DIMENSIONS (mm)	MATERIAL	APPROX. TOTAL WEIGHT (kg)	HEAT TREATMENT / REMARKS
32	Flame proof sockets 3 phase	2				
33	PLC Panel including software and hardware (along with 19 inch monitor with a data storage of atleast 3 hours) as mentioned in Section C4	1 set				
34	Miscellaneous items (general wiring items, armoured Cu power cables, control cables, installation accessories, cable trays & accessories etc.)	Lumpsum				
35	MCBs / ELMCB/RCBOs	Lumpsum				
36	GI Conduits & accessories	Lumpsum				

Notes:

HYDRAULIC JACK & POWER PACK SYSTEM

1.0 SYSTEM DESCRIPTION

The hydraulic circuit consists of four hydraulic jacks that are operated by two interconnected hydraulic power packs.

2.0 BACKGROUND INFORMATION

2.1 The hydraulic jack system is required for lifting of the MLP with Launch Vehicle.

2.2 Weight of MLP with launch vehicle, to be lifted: 600 tons

2.3 Approximate Size of MLP to be lifted: 10000mm (L) x 10000 mm (B) x 7300mm (H)

2.4 Four nos. of synchronised double acting hydraulic jacks are located in the support blocks at the four corners of the Bogie System. The hydraulic jack is placed on a wheeled tray placed within the support block for ease of handling.

2.5 The stroke required for the jack is 150 mm.

2.6 The speed of lifting or lowering under load is 10 mm / min.

2.7 In order to achieve all the hydraulic functions of jack operation, two hydraulic power packs shall be mounted on the bogie system structure and all the jacks for MLP lifting shall be connected by interconnecting piping from the power packs. Jack lifting shall be achieved through solenoid operated direction control valves selected by operator from control panel which is to be located in the bogie structure. Provision shall be made for individual operation of MLP lifting jacks. Initially all the four jacks will be operated simultaneously. Later, individual jacks may be operated based on the requirement and level difference of each bogie unit.

2.8 As the MLP has to be lifted/lowered precisely, it is required to monitor the level at each corner so that the operation can be done uniformly by isolating a particular jack. To achieve this, a monitoring system is to be incorporated in the control panel at each 300t capacity hydraulic jack and control system in the control panel.

2.9 Apart from providing pressure gauges at eight outlets of hydraulic power units for monitoring the pressure values, suitable pressure transmitter/ transducers shall be provided at the outlets with digital display of readings at control panel.

3.0 SCOPE OF WORK

This section covers the requirements for the Hydraulic System required for the Lifting of MLP with launch vehicle.

3.1 Understanding the bogie jacking system and designing the complete hydraulic system (Power pack and other associated components).
3.2 Submission of design details and obtaining approval.
3.3 Submission of the drawings and documents as per the technical specification.
3.4 Supply of all the equipment.
3.5 Installation of jacks, hydraulic system, electrical and control components including piping and cabling works.
3.6 Testing and commissioning.
3.7 Submission of recommended installation drawings, as required.
3.8 Implementation of safety at different stages of erection and commissioning.
3.9 Reliability and quality assurance during manufacture and testing of the equipment.
3.10 Submission of guarantee for efficient and specified performance of the total equipment. In case, any item is found to mal-operate or fails to provide specified performance during inspection/ testing or during commissioning/ trial runs of the system or during guarantee period of one year after commissioning, the supplier shall attend to the faulty/defective item within 48hours and make necessary repairs/ replacements to the satisfaction of the department, without any commercial implication.

4.0 REQUIREMENTS FOR HYDRAULIC POWER PACK

The hydraulic jacks for lifting the MLP with Launch vehicle shall be operated by two hydraulic power packs. These two power packs are interconnected and each shall contain a pumping unit with hydraulic high pressure radial plunger type piston pump operated by flame proof electric motor. Split flow piston pump with two identical outlets is preferred. The oil tank shall have an oil level indicator, oil cum air breather, return line filter, drain plug etc. The power pack also shall have safety relief valves, non-return valves, oil distributer with flow control and shut off valve with inlet to pump and outlets to four jacks. Flame proof DOL starter and cable of suitable length shall be provided. Provision for supplying oil to the pilot operated check valve near jacks to be made. The power pack shall have a manual pumping provision with quick interchange facility. The manual pump shall operate with effort less than 35kg and shall provide the rated lift in 5 min of pumping. The power pack shall supply oil under pressure for operation of pilot operated check valve.

5.0 SCOPE OF SUPPLY:

The scope of supply for complete package of jacks and hydraulic system for MLP lifting shall include the followings:

Sl.no	Description	Quantity
1.	300t capacity hydraulic jack assembly with tilting saddles and trolleys including MLP lifting monitoring and control system	4 no.s + 2no.s (spares)
2.	Hydraulic power unit with 8 directional control valves and ports, system fluid (upto and including commissioning) and pressure monitoring system for the power unit.	2 set
3.	Electric panel/ power panel with control switches and cables (located away from power pack).	1 Set
4.	Interconnection tubing, tube fitting, clamps, hose assemblies etc. for piping between hydraulic unit and hydraulic jacks (located at 4 corners at 7.5m x 7.5m span bogie unit)	2 set
5.	Seal kits for hydraulic jacks	6 sets
6.	Seal kits for hydraulic power unit	2 set

Make:

1. Europress

6.0 LOCAL CONTROL PANEL

A local control panel shall be provided by the Contractor for the operation of the various drives of the MLP Lifting system. The interconnecting cables between the local control panel and Sensors / Instruments / hydraulic power pack shall also be supplied by the Contractor.

7.0 EQUIPMENT AND SERVICES TO BE PROVIDED BY THE CONTRACTOR

7.1 Four numbers of 300 t capacity (2 spare) hydraulic jacks with stroke length of 150mm and of M/s EPP Euro Press Pack make with closed shut height upto 420 mm including lock nut and tilting saddle.

7.2 Electrical junction box/ power panel, located away from power pack suitable for group II B, Zone-1, T4 Class.

7.3 Oil tank with filters, air breather, level gauge etc.

7.4 Pumping unit with two nos. of Split Flow Pumps of adequate flow rate and pressure and suitable electric motors of adequate speed and power rating for the lifting operation

7.5 Electric motors suitable for Group-II B environment, zone-1, T4 temperature class. Insulation class F and insulation temperature rise shall be limited to class B.

7.6 Hand pump (for use in case of power failure)

7.7 Directional Control Valves, Check Valves, Safety Relief Valves, etc suitable for group II B, Zone-1, T4 Class.

7.8 Pressure gauges, pipelines, pilot operated check valves etc.

7.9 Operator's panel or control panel (located away from the power pack) suitable for group IIB, Zone-1, T4 Class.

7.10 Entire length of piping required from power pack to the four nos, hydraulic jacks mounted at 7.5X7.5 m span on bogie structure with suitable clamping arrangement.

7.11 Flexible hoses required for connecting hydraulic jacks with the pipelines.

7.12 MLP lifting monitoring and control system at each hydraulic jack.

7.13 Pressure monitoring system by incorporating suitable pressure transducers/ pressure transmitters for monitoring the outlet pressures of four outlets of hydraulic power pack.

7.14 Electrical power/ control/ data cables required for erection of the Hydraulic Jacking system including power cables from building electrical panel to power panel of jacking system and their installation. Length of cable shall be minimum 50m with male and female power 3 phase flame proof socket arrangement for total load.

7.15 Contractor has to design and envisage various voltage levels required to fulfil the performance of the entire bogie system.

7.16 All other items, which are not listed in the above description, but are required for successful operation of Hydraulic Jacking System.

7.17 Inspection and testing at Supplier's shop, packing and forwarding, transportation to SDSC SHAR.

7.18 Installation, testing and commissioning of Hydraulic Jacking System at SDSC SHAR.

7.19 Painting of all equipment as per the detailed specifications.

8.0 EQUIPMENT AND SERVICES TO BE PROVIDED BY ISRO

Electrical supply at a common power panel on bogie structure extended from the building.

9.0 TECHNICAL PARAMETERS OF THE HYDRAULIC SYSTEM / JACKING ARRANGEMENT

9.1 Four nos. of 300 t capacity (2 spares) MLP lifting hydraulic jacks and hydraulic system shall be mounted on bogie structure at specified locations as per attached drawing.

9.2 Measurement devices shall be mounted to monitor the rise/ lowering of each jack and the same shall be displayed at control panel.

9.3 At each outlet of Hydraulic Power Pack, pressure transmitters/ transducers shall be mounted with display provision at control panel.

9.4 Measurement devices shall be compatible for group II B environment.

10.0 GENERAL TECHNICAL DATA OF THE HYDRAULIC SYSTEM

10.1 The hydraulic units shall be designed and rated to the instructions and recommendations of DIN, CETOP and ISO.

10.2 All units shall be piped and terminated with companion flanges/ fittings including oil trays as required.

10.3 The companion flanges/ fittings on the manifold blocks are the take-off points for the interconnecting piping.

10.4 Provision shall be made for pressure check connections. All such connections shall be equipped with minimess couplings.

10.5 Hydraulic fluid shall be fire retardant type.

10.6 Solenoid valves: JIC, Oil immersed Coils, Manual override and indicating lamps

10.7 All electrical appliances to be wired up to a common junction box/ power panel.

10.8 Sealing material shall be compatible with the hydraulic fluid.

10.9 High pressure series thermoplastic flexible hoses shall be used.

10.10 Piping shall be seamless stainless steel tubes of material no. 1.4571 to DIN 17458 (1985) with outside diameter to tolerance class D4 and wall thickness to tolerance class T4 as per DIN 2462 Part 1-1981

10.11 Tube fittings shall be of EO-2 Ermeto Parker Fluid connector or equivalent.

10.12 Shut off/ isolation valves shall be ball valves with SS internals.

10.13 Provision shall be made for operating the power pack using a hand pump also in case of power failure.

11.0 DESIGN INPUT

Design input for sizing and selection of jacks and associated hydraulic equipment (preliminary design parameters) is given below for guidance to the Supplier. The Supplier shall work out and submit detailed technical specification of the Jacks and the associated hydraulic system and controls that would meet the exact functional requirement of the Jack system.

11.1 MLP Lifting Jacks

Specifications:

Total Number of Jacks	Four + two (spares)
Make	Europress
Jack Type	Double acting hydraulic cylinder with safety nut and transport trolley
Capacity of each jack (Push), Min	300 t (approx.)
Capacity of each jack (Pull), Min	94 t (approx.)
Closed shut-off height of Jacks with trolley, tilting saddle and lock nut	Upto 420mm
Stoke length	150mm
Rate of lift & lowering under load	10 mm / minute (approx.)
Weight of Jack	172 kg approximately

Design Features:

Parts	a. Pilot Check valve and pilot pipe b. Fitted with screw type quick couplers with female thread c. Pressure gauge 0-1000 bar, glycerin filled d. Safety relief valve e. Lift Monitoring device (group II B compatible)
Ram	Screwed with metric trapezoidal thread and complete with locking collar. Threads on lock nut , ram and jack body shall be designed to take the full load and upto an overload of 225%
Saddle	Maximum diameter of 200mm , tilting angle of 5 degrees with anti-skid top surface
Size of Cylinder	Maximum 400 mm OD. The size of the ram and operating pressure may be suitably selected to accommodate the overall sizes as given above. Testing as per ASME B 30.1-1992

Material	Forged Carbon Steel (DIN Ck 45) or superior
Surface Quality	Inner surface of cylinder shall be given an Integral Nitreg ONC treatment. Outside surface of the ram and thread shall have a heat treatment and nitrogen gas and subsequent oxidation. Body of jack shall be anti-corrosive treated.
Sealing	The seals shall be of very high quality compatible with system fluid. (PTFE bronze filled sealing with energizing O-ring) or better
Hose connection	From termination of rigid piping up to the jacks, hoses of high pressure thermoplastic type of about 2 metre length are to be provided. The end connection shall be QC/QD type with male connection on the jacks and rigid piping ends. Pressure gauges shall be mounted on rigid piping near the jacks (one gauge for each jack) for visual indication of pressure.
Operation	Remotely operated from Control panel situated nearly 20 meters away from jacks.
Operational requirement	Synchronous movement of all jacks with an error not exceeding ± 1 mm over full stroke. All the four (4) jacks shall lift/lower equally and positively throughout the movement to prevent tilting of load lifted/ lowered.
Trolleys	The trolleys for jacks shall be meant for easy maneuverability. It should be sturdy with four nos. of lockable swivelable cast iron castor wheels of suitable capacity.
Hydraulic fluid	Fire retardant type synthetic fluid

11.2 Hydraulic Power Pack For MLP Lifting Operation

The hydraulic power pack shall supply high pressure hydraulic fluid to four (4) nos. of 300t jacks for MLP lifting

The power pack shall be complete with two (2) nos. of high pressure 4-split flow type pumps operated by flame proof electric motors.

It shall be possible with the help of a selector switch on control panel to select any of the pumps as working pumps at any point of time.

The power pack shall also have a hand pump to deliver 3.5cc/ stroke at 1000 bar to operate the jacks in case of power failure.

The oil tank shall be made of stainless steel and complete with all the accessories, viz. oil level indicator, filter-breather, level switch, return line filter, drain cock etc. Capacity shall be adequate for the operation of the four jacks.

The power pack shall have safety relief valves and other necessary hydraulic components suitably mounted, piped-up with stainless steel pipe work and wired to a common junction box. Operating valves shall be mounted on suitable manifold blocks so that piping work is minimized to avoid leakage points.

Four solenoid operated DCVs should be provided extra other than those connected to the four jacks.

Direction Control Valves shall be operated with 24 V DC Class F Solenoids.

Pilot operated check valve shall be provided on individual MLP lifting jacks for holding the load. The operation of lifting/lowering shall be smooth and jerk free.
The power pack shall have pressure gauge (0-1000 bar), one for each outlet of hydraulic power pack and also pressure transmitter/transducers for the pressure monitoring in control panel for all the outlets.

All electrical equipment shall be designed for explosion proof service suitable for flame proof of group II B environment as per IS/IEC 60079-1: 2001, for hazardous area zone 1 as per IS 5572: 1994 and temperature classification T4 as per IS/IEC 60079-0: 2004, IP 55 enclosure. Capacity of tank etc. mentioned in this document are nominal only. The supplier has to specify capacities of all items and submit calculations to establish adequacies of capacities.
Control panel shall be connected to lift monitoring devices in jacks with FRLS cable.

12.0 DESCRIPTION OF HYDRAULIC EQUIPMENT

Major units of the hydraulic system are indicated below:

- Tank unit with mounted accessories
- Pumping unit
- Valve stand
- Pipe mounted items
- Jacks with mounted items
- Interconnecting piping and flexible hoses
- Electrics and controls

All other items required for completing the system in all respects to achieve the functional requirements in an integrated manner shall be included in the scope of supply of the supplier. Broad coverage of items for above major units is also indicated below for guidance.

12.1 Tank and accessories

Tank – 2 Sets

Fluid tank, 100 liters capacity, stainless steel 316, rectangular design	2 No.	For fluid storage

Tank Accessories: - 2 Sets

Oil level indicator	1 No. per Tank	for visual level indication
Filler/breather	1 No. per Tank	to compensate level difference and to refill fluid
Temperature gauge	1 No. per Tank	for visual temperature reading
Drain valve	1 No. per Tank	To drain the tank
Return line filter	1 No. per Tank	To filter the fluid coming back to tank level
Level switch	1 No. per Tank	For level control
Temperature switch	1 No. per Tank	For temperature control

Pumping Unit – 2 Sets

4-split flow pump	2 Nos per Pumping unit	To supply pressurized fluid
Electric motor	2 Nos per Pumping unit	To drive the pump
Pressure relief valve	5 Nos per Pumping unit	Safety protection against excessive pressure
Hand pump	1 No. per Pumping unit	To supply pressurized fluid in case of power failure
Check valve	1 No. per Pumping unit	To avoid back flow

Note

1: Power unit consisting of all the above units except the electrical junction box/ power panel, shall be assembled in a composite manner complete with piping work up to the take-off point interconnecting piping for connecting to the cylinder ports. The electrical junction box/power panel and the control panel shall be fixed away from the hydraulic power pack.

2: The tank, entire piping and fitting shall be of stainless steel. The hydraulic unit consisting of Tank, Pumping Unit, Filters, Valves, etc. shall be assembled and located inside an all-weather steel cabinet. The cabinet shall

be suitable for being located in open air in marine environment on the maintenance platform of bogie system.

Interconnecting Piping

The scope of Interconnecting piping including entire piping work complete with tubing, tube fitting, tube clamps, valves and hose assemblies complete with end fitting to connect the piping with the jacks for leak proof and efficient hydraulic power transmission. Special fixing/ mounting brackets/clamps required, if any, shall be installed by the supplier.

Synchronized Lifting and Lowering

A split flow pump is like having several pumps of equal displacement connected to a single power source. The pump that will be used for this purpose is a four- split flow pump with two different flow rates. Using these pumps, 300 t or higher capacity jacks (4 nos.) shall be raised/lowered at a speed of 10 mm/minute.
The power unit shall be designed to allow independent operation of the in a synchronized way with an error not exceeding ± 1mm over full stroke. The pilot operated check valves in the circuit shall keep the pressure in the main chamber of the jack cylinder until the piloting flow from the retraction port will release it. A feedback system shall be provided on each hydraulic jack by mounting sensors to monitor the amount of lift/ fall of each jack

Sequence of Operation:

The pumps shall have redundancy for operation of the four jacks for specified lifting/lowering rate.

After selection of the required pumps, all jacks for the respective operation shall be operated simultaneously to perform uniform lifting/ lowering. The amount of lift is continuously monitored and if required, a particular jack will be isolated from operation.

13.0 DESIGN CONSIDERATIONS AND TECHNICAL NOTES

13.1 Pump-motor units/ Power Unit Assembly shall be mounted on anti-vibration pads.

13.2 The unit shall be provided with Anodised Circuit Plates and same shall be suitably fixed on the power unit for direct reading

13.3 Tungsten Inert Gas (TIG) welding shall be done at all butt weld pipe joints if any

13.4 The supplier shall submit the material test certificate for manifold block.

13.5 Selection of valves shall be as below:

a) Direction Control Valves should be selected for maximum 5 bar (P to A and B to T taken together) pressure drop for blind end flow.

b) Speed control valves should be selected for maximum 5 bar (maximum open condition) pressure drop.

c) Total pressure drop in any circuit including manifold block of valve stand, for the flow indicated for the circuit should not exceed 15 bar. Pressure drop shall be measured by short circuiting A & B ports by providing pressure gauges at P & T lines and measuring flow by a digital flow meter.

d) All solenoid coils to be rated for continuous duty.

e) After fabrication, all pipes to be cleaned, degreased, pickled, neutralized, rinsed and lubricated.

f) All pipe lines to be clamped with tube clamps of poly propylene heavy series or equivalent.

g) All electrical items such as direction control valves, level switches etc. to be completely wired up to the electrical junction box/power panel. Spare terminals shall be provided.

h) Sizes and model numbers of different valves as indicated in quotations will be binding on supplier. After placement of order, during approval of schematic drawings if supplier finds certain valves having more pressure drops than stipulated in the tender specification or in the circuit including manifold the total pressure drop is found to be more than 15 bar for the same flow as mentioned in the tender drawings, the supplier shall use higher size valves (without any price implication) to limit the pressure drops.

i) Inspection shall be carried out on the basis of approved drawings and QAP.
The supplier for the complete package shall arrange inspection and testing.
Representative of ISRO will participate in the inspection at supplier's works.

The supplier shall arrange everything including power, consumables, manpower, equipment, instruments etc. required for inspection and testing. Two-week notice shall be given to ISRO for inspection. Pressure test certificates, internal inspection report, material test certificates shall be enclosed with the inspection call.

j) All systems and piping (except jacks, which will be tested as per ASME B 30.1-1992) shall be pressure tested at 1.5 times system working pressure. Performance test and pressure drop test shall be carried out during inspection as per submitted QAP by tenderer and approved by ISRO. After testing, the unit (including tank) shall be filled with the system fluid and all open terminations shall be closed for air tightness.

14.0 ELECTRICAL CONTROLS

Control Philosophy for the system

a) Dry run protection of hydraulic pumps shall be provided
b) Hydraulic power unit of jacking system shall be provided with following control features in a local control box:

- Main power ON/OFF
- Pumps ON/OFF with HIGH/ LOW flow selection mode for each pump
- Selection of individual operation of jacks in UP/ DOWN direction.
- Display of MLP jack RISE/ LOWERING in mm
- Display of hydraulic power pack outlet pressures
- Indication lamps to indicate the pump/ jack operation.

Electrical Specifications

a) The scope of supply includes all equipment of power and controls to meet the functional requirement as per the control philosophy of the jack operations.

b) Main power will be made available by SDSC SHAR at one point for the entire power and control requirement. Distribution of power from this point to a power panel and from there to the control panel is in the scope of the supplier.
c) Any other voltage/ power conditioning/ power regulation/ EMI protection required for Electrical and Controls supplied by the supplier, shall be provided by the supplier

d) Enough numbers of I/O's shall be provided by the supplier so that 20% spare I/O's are available after commissioning of the equipment.

e) The electrical junction box of power pack and the control panel shall be mounted separately on bogie structure away from the power pack for easy maintenance of the hydraulic units of power pack.

f) Motor selection shall be such that at full load operation, motors shall not draw more than 70% of its rated load.

g) The equipment offered shall also conform to rules and regulations of Fire Insurance Authority.

h) All electrical equipment shall be tested and certified by statutory authorities for use in specified gas group locations. Certification number/ date and gas group

classification must be indicated on the manufacturer's nameplate on each junction box/control panel.

i) All electrical equipment shall be flame proof of group II B environment as per IS/IEC 60079-1:2001, for hazardous area zone- I as per IS/IEC 60079-0:2004

j) Available power supply is 415 V ± 10%, 3 Ph, 4 wire, frequency 50 Hz ± 5 % and auxiliary supply is 240 V, 50 Hz, AC supply.

k) All the electrical equipment should conform to latest standard BIS codes and the practices followed for design, installation, testing, commissioning, operation and maintenance. Tests shall also conform to international standards IEC/VDE/DIN/BS. The supplier shall submit all the relevant test certificated to ISRO

l) Motors shall be of Siemens/ Crompton Greaves/ Kirloskar / ABB/ Bharat Bijlee/ Lakshmi Hydraulics make only.

m) Power Cables shall be of NICCO/ IACL/ Universal Cables/ Fort Gloster / KEI/ Incab/ Uniflex Cables/ Havells make only.

n) Junction boxes shall be FCG flame proof controls pvt ltd, Baliga and Sthal only.

p) Data and control cables shall be Delton Cables/ Paramount Cables/ Uniflex Cables/ NICCO/ KEI make only.

q) Push button/ indicating lamps shall be of Siemens/ L & T/ BCH/ GEC make only

r) Control switches shall be of Siemens/ L & T/ Kaycee make only.

s) Panel meters/multi-function meters shall be OMRAN/ Aplab/MECO/IMP/ Automatic Electric, siemens, schiender make only.

t) All cables shall be of FRLS type. Power cables shall be armoured.

OPERATING CONDITIONS:

LT power supply conditions:

Voltage	415 ± 10 %, 3 Phase, 4 wire
Frequency	50 Hz ± 5%
Combined Variation	10 % max (absolute value)
Designed short time rating	50 kA for 1 sec
System earthling	Solidly earthed
Auxiliary supply	240 V. 50 Hz, AC

15.0 INTERFACE DETAILS OF JACKS COMPLETE WITH HYDRAULIC POWER PACK FOR MLP JACKS AND THE RESPONSIBILITY MATRIX

Activity/ Units	**Interface/ Execution Responsibility**
Location of Hydraulic Power Pack	Hydraulic Power Pack shall be

	mounted on the bogie system
Size of Hydraulic Power Pack and method of fixing it to bogie	Approximate size should be 1000 x 600 x 1000 mm height. Power Pack shall be of **skid mounted** type and shall be bolted to the frame of bogie interconnecting structure as indicated in drawing.
Piping between Power Pack and Jacks	Hydraulic System Piping from Power Pack to Jacks shall be routed along the frame of bogie system
Supply of Electric & Controls	By the supplier
Supply of Hydraulic Equipment& Piping/hoses (Hydraulic Power Pack with power/control wired up to electrical junction box/power panel mounted in power unit)	By the supplier
Supply of measuring devices for monitoring movement of 300t capacity hydraulic jacks on bogie structure and control panel and wiring	By the supplier
Supply of Pressure monitoring system & DPMs for monitoring the main pressure of four outlets of power pack	By the supplier
Delivery of Hydraulic equipment	To SDSC SHAR
Erection of Hydraulic Equipment and Piping	By the supplier
Quality assurance during erection & Testing	By the supplier
Commissioning	By the supplier
Electrical Supply	By SDSC SHAR
Power cables to electric motor(s) in Hydraulic Power Pack & Control cables from Control Panel to Junction box in Hydraulic Power Pack	By the supplier

16.0 PACKING, TRANSPORTATION & SAFE STORAGE OF ITEMS AT SDSC SHAR

a) No equipment shall be delivered without obtaining dispatch clearance from SDSC SHAR.

b) Party has to pack all the items in seaworthy packing to protect against corrosion. All the equipment shall be properly packed to avoid any damage during transportation/ handling/storage

c) The supplier shall be responsible for transporting all the equipment to site, unloading and storage.

d) The equipment received at site shall be stored at a place assigned for this purpose

16.1 GENERAL ERECTION PROCEDURE

a) Equipment delivered at site to be inspected and checked as per Packing List. Different units to be placed on respective positions and to be leveled & aligned. Packing plates/ shims to be used as required.

b) Pre- fabricated interconnecting piping to be assembled between the power pack and jack (fabricate piping segment wherever required to complete the piping layout and clean the piping segments by approved cleaning procedure of pickling, passivation, rinsing, drying and oiling).

c) Fixing bolts to be tightened evenly.

d) Levels of equipment to be rechecked.

16.2 INSTALLATION OF SUPPORTS

a) All supports shall be checked for horizontality and verticality before fixing.

b) Supports shall be so attached that there is no shock/ vibration in any portion of the pipe work.

c) Supports shall be properly bolted/welded to prevent deformation/ slop-off after installation of piping.

16.3 PIPELINE INSTALLATION

a) Pre-assembled pipelines are to be stored to avoid deformations/constrains.
b) Pipelines shall be connected to mechanical equipment after final alignment and leveling. The connections shall be free from stresses.

c) Pipelines shall not interfere with other pipes/equipment/installations

d) Piping close to equipment shall be installed in such a way that dismantling and inspection of the equipment will not be hindered.

e) Edge preparation of pipes for welding shall be to ANSI B 16.25-1992 will be ground smooth.

f) The welding surfaces shall be uniform, smooth and free from surface defects, rust, scale, grease, paint etc. welding shall be free from slag.

g) After ground fabrication, pipelines shall be placed in position on temporary supports and ‘in-situ’ welding shall be carried out, if necessary.

h) Hydraulic pressure testing of piping for hydraulic lines shall be carried out at 1.5 times system working pressure.

i) Painting shall be carried out as per painting specification

16.4 PIPE CLAMPING

a) All the pipes shall be clamped and supported with Polypropylene Pipe Clamps (PP Clamps).

b) Generally, pipes shall be clamped at every 1.5 meters in straight run. At bends clamps shall be provided on either side of bend, on straight length of pipe, as close to bend as possible.

c) The support can be provided from top/bottom of pipe as per site condition.

d) The clamp can be directly welded to the structural body or to the angle/channel welded to the structural body depending upon the site condition.

e) Before welding the weld plate of PP clamp to the structure/angle/channel, the PP clamp is to be dismantled and Polypropylene part separated from steel part to avoid burning of the polypropylene part.

f) After welding of weld plate is completed and the plate cools down, the bottom half of PP clamp is assembled with weld plate. On the bottom half of PP clamp, pipe is placed. On top of the pipe, the top of PP clamp is placed. Then top plate is placed in position, the bolts are inserted and tightened. This completes the clamping procedure.

17.0 INSPECTION, TESTING AND COMMISSIONING AT SUPPLIER'S SITE

a) All hydraulic cylinders will be tested at 125% of the rated hydraulic pressure. The test shall be conducted in the supplier's premises and a test certificate shall be submitted to the Department

18.0 INSPECTION, TESTING AND COMMISSIONING AT DEPT. SITE

b) Checking the operation of all hydraulic pumps from control panel.

c) Checking the combined and individual operation of all four nos. of 300t hydraulic jacks for their raising/lowering for minimum five times.

d) Checking the raising / lowering values of 300t hydraulic jacks at control panel during their operations.

e) Checking the indication of pressure of four outlets of power pack at control panel.

f) Stage wise and/or final inspection will be carried out on the basis of approved circuit drawings and QAP. Pressure test certificates, internal inspection reports, material test certificates and manufacturer test certificates shall be enclosed with the inspection call.

g) In case, any equipment is found to malfunction or give sub-standard performance during this activity, it shall be replaced free of cost.

19.0 DOCUMENTS TO BE SUBMITTED

19.1 DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER

a) Signed copy of this Technical Specification as a proof of compliance to all the requirements of the document.
b) Confirmation of make of hydraulic Jack Assemblies.
c) Dimensional details of the proposed hydraulic jacks
d) Detailed hydraulic circuit of the system to meet all the requirements.
e) Preliminary design calculations for hydraulic system.
f) Preliminary Quality Assurance Plan (QAP) which will be followed.
g) Detailed specification, schematic drawing, Bill of Material (BOM), complete with the features indicated in the order specification.

h) Calculations for selecting size and model number of each component.
i) Wiring & terminal details with connection scheme.
j) Brief specification of lift measurement device.
k) Brief specification of Pressure Monitoring system and DPMs for outlets of hydraulic power pack.
l) Any other relevant data/information.
m) List of spares being supplied along with the system which are sufficient for maintenance of five (5) years.

19.2 DOCUMENTS TO BE SUBMITTED AFTER PLACEMENT OF OFFER

a) Detailed specification, schematic drawing, Bill of Material (BOM), complete with makes and model no. of all components incorporating all the required details against the features indicated in the order specification
b) Calculations for selecting size and model number of each component.
c) Electrical control block diagram, control scheme and operational write-up.
d) Wiring and terminal details with connection scheme.
e) General arrangement drawings and cross sectional details indicating dimensional details for the equipment and bill of material.
f) Interconnecting piping layout and BOM
g) Fabrication drawings indicating material and dimensional details.
h) Certified detailed technical literature of all components highlighting all the features of the items finally selected.
i) Safety, reliability and quality assurance plans followed for each type of equipment.
j) Testing and calibration procedures for each type of instrumentation.
k) Installation drawings and instructions for various units and for each type of equipment.
l) Weight of each unit.
m) Copies of Purchase Orders for bought-out items blanking price part (one copy only).
n) Any other relevant data/information.

19.3 DOCUMENTS TO BE SUBMITTED AFTER COMMISSIONING

a) Three (3) sets of Operation and Maintenance Manuals, spare parts catalogue, engineering data sheets and part lists covering each item including bought out components along with all drawing shall be compiled and submitted.
b) One set of reproducible and soft copy on CD/DVD for all drawing and operation & maintained manuals.
c) As built drawing (3 copies).
d) Design calculation and analysis data if any.
e) Complete Inspection / test results (3 copies).
f) Inspection certificate & guarantee certificate (3 copies).

20.0 QUALITY ASSURANCE PLAN

20.1 Tenderer shall have an established and effective Quality Assurance plan during manufacturing the system. The SR & QA plan shall be submitted for approval of ISRO.

20.2 Tenderer shall perform Reliability Engineering study to ensure safe & reliable operation of Systems/Equipment.

20.3 Tenderer shall ensure that the item supplied is absolutely safe for use in the stipulated work environment and conform to applicable safety norms and standards.

20.4 Safety Analysis shall be performed with objective of elimination of operational hazards, making the design fail safe by providing safety/ operational interlocks, monitors, self-diagnostic features , alarm annunciation etc.

20.5 During manufacture, fabrication assembly, testing and delivery, the vendor shall strictly comply with Quality Assurance instruction including Cleanliness Control, procurement Control, Design change Control, Deviation Control, Failure Reporting & Analysis, Calibration Control, documents control & Training requirements.

21.0 GENERAL INSTRUCTION TO THE CONTRACTOR

21.1 The items covered in this specification shall confirm to technical specifications, latest revision of relevant standards and requirements in respect of accuracy, response time, performance, dimensions, materials of construction manufacturing, safety, reliability & quality assurance, inspection and testing

21.2 The supplier shall keep essential commissioning spares available at Sriharikota during commissioning phase, a list of such spares shall be furnished in four weeks after order placement.

21.3 The supplier shall ensure continued availability & supply of all the items/ equipment to be supplied under this package along with required spare parts of the supplier make for a period of at least 15 years from the date of contact. For bought out items, the clause shall be applicable for 10 years only.

21.4 All the equipment and accessories to be supplied under this package shall be new & from the latest product range of the supplier.

21.5 The Supplier shall list out all the equipment along with their components/ parts, including make, type, model number and the other details for the approval of SDSC SHAR. Any deviation from it after approval shall be permitted.

21.6 All correspondences /documents shall be in English language and the data /calibration details shall be submitted in Metric Units only.

21.7 The supplier shall indicate any assumption made in respect of specification, data of any other details that have not been mentioned in this order but considered necessary for sizing & selection of equipment to meet the specified application requirements. All such assumptions will not be binding on ISRO unless expressly agreed upon. The supplier, under these conditions, shall supply equipment based on the data accepted to ISRO without any commercial implication.

21.8 All necessary facilities including tools, tackles, testing equipment, instruments, accessories, system fluid, manpower assistance etc. shall be provided by the supplier to enable inspection of equipment by ISRO during its manufacture/ fabrication/ assembly & inspection.

21.9 The supplier shall be responsible for adherence to all the applicable rules, regulations & requirements of statutory bodies of the Andhra Pradesh State Government and Central Government of India, as required.

22.0 COMPLIANCE TO STANDARDS

All the items supplied or used shall be new and of first quality and shall be manufactured/ fabricated and tested in accordance with the latest editions of the relevant Indian. Intentional Standards. All components shall be manufactured in accordance with the relevant standards published in the country of manufacture after allowing for the specific aspects under the Indian site conditions such as tropicalisation etc. Any components or systems where no specific standards are applicable shall be fabricated as per the instructions and directions of the purchaser or its authorized nominee.

23.0 QUALITY OF MATERIALS AND WORKMANSHIP

All equipment, materials and articles incorporated in the work should be new, free from defects and of the most suitable grade for the purpose intended. All work under this contract shall be performed in a skillful and workman-like manner and shall be consistent with the best practices of the industry.

If at any time SDSC SHAR (ISRO) notifies that any such equipment, material, article or workmanship fails to meet the foregoing standards, the contractor shall promptly take all the remedial steps required to meet those standards

24.0 OPERATION INSTRUCTION AND PROCEDURE

The Supplier has to submit the 'brief step-by-step operation procedure' as conceived by the designer for approval at detailed design stage itself. After testing and commissioning stage the updated document shall be submitted for final clearance and approval. Three copies of the same shall be supplied. Permanent physical identification, which are legible, clearly visible at any stage of operation etc. and markings shall be given on the system where the operator ha to carry out his work. Procedure should be well detailed and it should identify all checkpoints before carrying out any operation. For each operation, a checklist has to be made for systematic check-up and operation. Operation manual shall include all minute activities and checkpoints in very detailed manner. The manual also shall include trouble shooting, possible causes and remedial measures to be adopted. Operation manual should include block diagrams showing clearly identification marks, operations and checklist number for each system. It shall also marl clearly possible areas of interference and the problem areas corresponding to the each point in the checklist. These diagrams may preferably be A3 size sheets or bigger size sheets.

25.0 MAINTENANCE INSTRUCTIONS AND PROCEDURE

Brief maintenance provisions/ procedure document shall be prepared and submitted at detailed Engineering stage itself. After testing and commissioning stage, the detailed document shall be submitted for final clearance and approval.

Three copies of the same shall be supplied.
Maintenance document shall include but shall not be limited to the following:

01. Block diagram of the system
02. Applicable drawings
03. List of all bought out items, detailed specifications and catalogues
04. History of the system
05. List of tools
06. Parts bins
07. List of consumables and maintenance schedules
08. List of spares
09. Systematic health checks procedure
10. Work prior to starting maintenance
11. Torque levels
12. Clearance
13. DB levels
14. Step by step procedure for dismantling of a sub-system
15. Step by step procedure for carrying of repair
16. Step by step procedure for re-assembling
17. Test results
18. Final report

PAINTING SPECIFICATION FOR BOGIE SYSTEM

1.0 SURFACE PREPARATION AND PAINTING

1.1 Complete Bogie System shall be painted as per the instructions given below.

a) All the shop-fabricated items shall be grit blasted, primer painted and then transported to site for erection.
b) The site fabrication items also shall be grit blasted and primer painted before erection.
c) After completion of the erection, all the damaged primer painted area shall be rectified.
d) After Primer painting, the total surface shall be painted as per the painting scheme stated in Clause 1.4 of this Specification.
e) Surfaces that may become inaccessible after manufacture / erection, shall be prepared and painted while still accessible during various stages of manufacture / erection as per the same procedure as stated in this specification.

1.2 PREPARATION OF SURFACES

a) All surfaces to be painted shall be clean, dry and free from oil, grease, dirt, dust, corrosion and weld spatters.
b) Any other surface contaminant except tightly bonded residues of mill scale rust is permissible to a limit of not more than 5% of whole surface and a maximum of 10% on any particular square inch area.

1.3 GRIT BLASTING

a) The entire surface of all the fabricated materials is to be Grit blasted as per near white quality of Steel Structures Painting Council (SSPC) standard of SA 2.5 of SIS 055900.
b) The surface profile after blasting shall be between 37-65 microns and should be jagged in nature.
c) Hand cleaning shall be carried out by chipping and scraping followed by wire brushing / abrasive wheels for items for which surface preparation is difficult by Grit blasting after taking approval from purchaser / TPIA. All surfaces shall be degreased using a suitable solvent to remove oil and grease and shall be dried off before painting.

1.4 PAINTING SCHEME

a) Immediately after Grit blasting, the following Painting Scheme shall be followed for Bogie System:

Sr. No.	Layers	Paint	Dry Film Thickness (DFT) (µm)
1.	Primer	Inorganic Zinc Silicate	65 (minimum)
2.	Intermediate Coat	High Build MIO Epoxy	75 (minimum)
3.	Final Coat	Acrylic Aliphatic Polyurethane	40 (minimum)

b) All paint and primer shall be of standard quality and procured from approved manufacturers as prescribed in the list furnished. The tenderer shall provide the purchaser “Elcometer” / Paint thickness measuring gauges free of charge and shall measure the thickness of paint in the presence of the representative of the PURCHASER at random locations selected by him.

c) Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

d) Field painting shall only be done after the structure is erected, levelled, plumbed, aligned and welded/connected in its final position, tested and commissioned. However, touch up painting, making good to any damaged shop painting and completing any unfinished portion of the shop coat shall be carried out by the Tenderer free of cost. The materials and specification for such painting in the field shall be in accordance with the requirements of the specification for shop painting.

e) Painting shall not be done in frosty or foggy weather or when humidity is such as to cause condensation on the surfaces to be painted. Before painting of steel, which is delivered unpainted, is commenced, all surfaces to be painted shall be dried and thoroughly cleaned from all loose scale and rust.

f) All field rivets, bolts, welds and abrasions to the shop coat shall be spot painted with the same paint used for the shop coat. Where specified, surfaces which will be in contact after site assembling shall receive a coat of paint (in addition to the shop coat, if any) and shall be brought together while the paint is still wet.

g) Bolts and fabricated steel members, which are galvanized or otherwise treated, shall not be painted.

h) Paints shall be stored under cover in airtight containers. Paints supplied in sealed containers shall be used up as soon as possible once the container is opened.

i) While painting the new structures, the already finished floors and structures shall not be spoilt. If there is any spillage of paint on the floors or members on the finished structures, the Tenderer has to clear and provide the painting to the spoiled areas.

j) Paints supply shall be checked for shelf life to meet the requirements before application. Proper action shall be taken well in advance prior to actual usage.

2.0 PAINT SPECIFICATIONS

2.1 The Technical Specification for the Paints to be used shall be as per MANUFACTURER’s specification duly approved by the PURCHASER.

2.2 Colour code will be finalised by DEPARTMENT after award of CONTRACT.

SPECIFICATIONS OF ELECTRICAL SYSTEMS

1.0 SCOPE OF WORK

1.1 The broad scope shall include the following electrics in the Bogie:

(a) 3 Phase distribution panel having LDB, PDB etc.

(b) Flame proof lights

(c) Power sockets

(d) Cables / Wires

(e) Earthing

2.0 CODES AND STANDARDS

2.1 The contractor shall provide all material, equipment and services so as to make a totally integrated and functional system together with all accessories and associated equipment in compliance with all applicable codes, standards, guides, statutory regulations and safety requirements in force.

2.2 The latest versions of the following statutory regulations and guidelines shall be followed for the design of electrical systems.

- Indian Standards
- International Electro technical Commission (IEC)
- All relevant ministries, government departments, agencies, and statutory & local authorities.
- CEA regulations.

2.3 The safety requirements as per the Factories Act, Electricity Rules and other applicable codes/standards etc shall be observed while developing the layout.

2.4 SDSC specification/ standards wherever applicable shall be followed.

3.0 GENERAL

3.1 The design ambient temperature for the all electrical equipment shall be 50℃ and relative humidity of 95% shall be considered.

3.2 LDB/PDB with 3 phase supply shall be provided for lighting distribution in the Bogie.

3.3 Flame proof tube lights (FTL) shall be provided on the maintenance platforms & Flame proof flood lights shall be located at strategic locations at the front & rear of the Bogie.

3.4 The distribution for the lighting system from LDBs shall be done by armored copper conductor cables for all the flameproof fixtures through appropriate junction boxes, conduits, flameproof glands and flame proof dummy plugs.

3.5 Earthing at required locations shall be provided by vendor.

4.0 DETAILS

4.1 Lighting DBs shall be of flame proof II B construction (Ex d) with minimum IP55 and with canopy. The feeders shall be provided with MCB/MCCB for overload/short circuit protection. ELCBs of suitable rating shall be provided for earth leakage protection.

4.2 Flame proof Ex d type of luminaries/socket outlets suitable for gas group IIB shall be provided.

4.3 LV Power Cables shall be 1100 V grade, multi core, stranded copper conductor of grade H4 and class 2, XLPE insulated, extruded PVC inner sheathed of type ST-2, galvanized single round steel wire armoured and with outer sheath made of FRLS PVC compound of type ST-2.

4.4 Cable terminations shall be through standard crimping type copper lugs for power cables. For all Cu terminations with Cu lugs shall be used. All bolted terminations shall be using ring type lugs.

4.5 Standard GI conduits of size 20 / 25mm shall be used for routing of wires / cables.

4.6 The structures, metal enclosures of all electrical equipment, conduit and trays shall be effectively grounded with double earthing and shall be connected to building earth.

4.7 Flexible ground conductors / Galvanised steel conductors shall be provided for grounding as required.

5.0 SCOPE OF SUPPLY:

Following are the requirement of instrumentation and data acquisition system,

S.No	Description	Make	Quantity
1.	3 Phase flame proof distribution panel with LDB, PDB, UPS, hydraulic jack supply incoming with outgoings	FCG Flame proof control pvt ltd, baliga, Stahl	**1 set**
2.	LED flame proof light fittings	FCG Flame proof control pvt ltd, baliga, Stahl	**12 nos.**
3.	Flame proof warning light fittings		**8 nos.**
4.	Flame proof Annunciator		**2 nos.**
5.	Flame proof sockets Single phase		**4 nos.**
6.	Flame proof sockets 3 phase		**2 nos.**
7.	PLC Panel including software and hardware	PLC system: Siemens/Schiender	**1 set**
8.	Miscellaneous items (general wiring items, armoured Cu power	Finolex, Polycab, KEI, Havells, Universal, RR	**Lumpsum**

	cables, control cables, installation accessories, cable trays & accessories etc.)	Kabel, CCI, Paramount, Apar, VGuard PATNY / INDIANA / PROFAB / ASIAN / GLOBE	
9.	MCBs / ELMCB/RCBOs	Legrand, L&T, Siemens, ABB, Schneider	**Lumpsum**
10.	GI Conduits & accessories, cable trays (separate trays for power and control)	Toshniwal, Steel kraft, Vimco**,** TATA, Jindal, Adharsa, JPC	**Lumpsum**

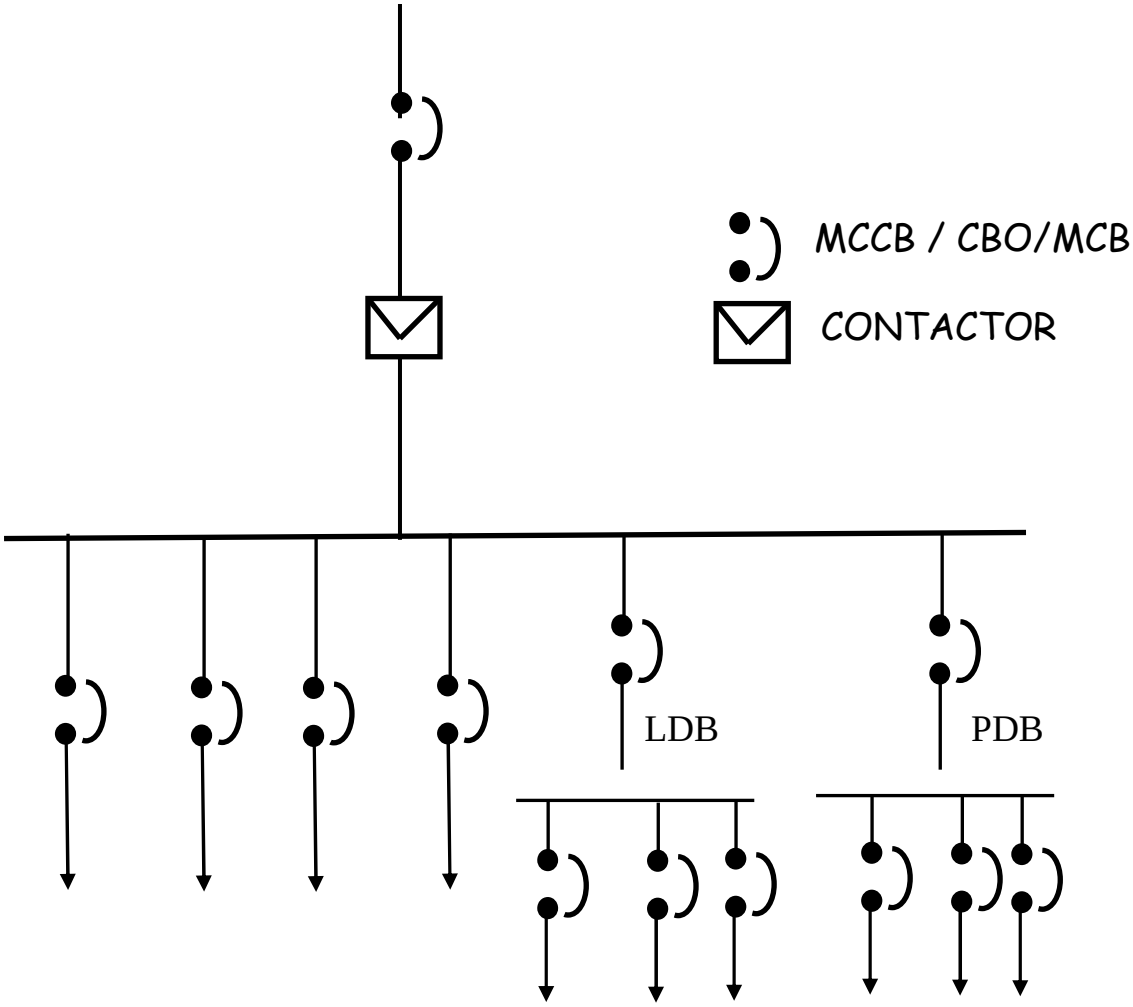
6.0 LIST OF RECOMMENDED MAKES

6.1 The Following list consists of brands/makes approved for incorporating in the project execution. For any reason, other brands are proposed by the vendor, those brands will be considered after thorough evaluation of the same , for which the vendor shall arrange for supplying the type/routine/acceptance test certificates , ISO/other quality standards testimonies , IEC/BIS certificates and if required the samples get tested in the National testing labs / authorized agencies as required.

Sl No	**Item**	**Subgroups**	**Recommended brands/makes**
A	**General wiring Items**		
1		FRLS Wiring wires	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard
2		Flexible multi core cables	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard
3		Switch/Socket etc	FCG Flame proof control pvt ltd, baliga, Sthal
4		MCBs / ELMCB/RCBOs	Legrand, L&T, Siemens, ABB, Schneider
5		LDBs/PDBs	FCG Flame proof control pvt ltd, baliga, Sthal
6		GI Conduits & accessories	Toshniwal, Steel kraft, Vimco**,** TATA, Jindal,Adharsa, JPC
B	**Power cables**	Armoured Cu	Finolex, NICCO/ Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, /RPG/ TORRENT CABLES LTD
C	**Flame Proof Light Fitting**		FCG Flame proof control pvt ltd, baliga, Sthal
D	**Local Control Panel**		
1		MCCB	Legrand, L&T, Siemens, ABB, Schneider
2		Power /control contactors	Legrand, L&T, Siemens, ABB, Schneider
3		Selector/Control switches	AREVA T&D /JYOTI /KAYCEE INDUSTRIES LIMITED/LARSEN & TURBO LIMITED /SIEMENS LIMITED
4		Connectors	Elmex/ Connect Well/Phoenix/Wago
5		LED indication Lamps	Bhartia industries limited/

			controls & switchgears co.limited/larsen & turbo limited/siemens /schneider electric india (p)/essen deinki /esbee/Binay/Jai balaji/vaishno
F	**Installation accessories**		
1		Cable jointing accessories Heat shrinkable	RAYCHEM
2		Cable Lugs	COMET / BRACO /JAINSON/ Billets Elektro werke ltd/ MULTI PRESSINGS/USHA MARTIN
3		Cable glands/plugs	FCG Flame proof control pvt ltd, baliga, Sthal
G	**Cable trays & Accessories (Separate trays for power and control)**		PATNY / INDIANA / PROFAB / ASIAN / GLOBE
		Control transformers	AE, Kappa
F	**Other system**		
		PLC Panel including software and hardware.	PLC system: Siemens/Schiender
		Miscellaneous items (general wiring items, armoured Cu power cables, control cables, installation accessories, cable trays & accessories etc.)	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard PATNY / INDIANA / PROFAB / ASIAN / GLOBE

Single line diagram for PIF Bogie Electrical Systems are mentioned tentatively and party has to design for the entire system



SNO	Some of the Load Details
01	Hydraulic Jacks
02	UPS
03	LDB
04	PDB
05	Instrumentation
06	sensors
07	Field elements
08	PLC

SL. NO.	COMPONENT/ OPERATION	CHARACTERISTICS TO BE CHECKED	METHOD OF CHECKING	CATEGORY	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	INSPECTION AGENCY			REMARKS
									VR	TP	IS	
A.	MATERIAL (RAW MATERIALS & BOUGHTOUTS)											
1	Rolled plates & sections Forged steel & Castings High Yield Steel	a. Appearance	Visual	Major	100%	IS:2062	Freedom from defects like pitting, cracks, etc.	--	H	H	R	
		b. Properties	Chemical analysis & physical test	Major	100%	IS:2062	Drawing, specification	Mill test certificates/ Lab reports	H	R	R	
		c. Internal flaws	UT	Critical	100% for plates ≥20mm thick, 100% for Castings & Forgings	ASTM A435	Specification	NDT reports	H	H	R	
2	Fasteners (high tensile bolts & nuts etc.)	a. Quality	Visual	Major	Sample check as per relevant specification	IS:1367	a. No cracks b. Proper matching with nuts	IR	H	W	R	
		b. Chemical composition & physical properties	Chemical analysis, mechanical test	Major	Sample check as per relevant specification	IS:1367	IS:1367 Part III	Manufac-turer's test certificates	H	R	R	
		c. Dimensional	Measure-ments	Major	Sample check as per relevant specification	IS:1367	IS:1367 Part III & XIII		H	W	R	
3	Wheel, Rail Clamp	Dimensional conformance	Measure-ments	Major	100%	As per Manufacturer's Specification	As per Manufacturer's Specification	IR	H	W	R	
		Performance Tests	Verification	Major	100%	As per Manufacturer's Specification	As per Manufacturer's Specification	IR	H	W	W	

Legend:
VR – Vendor
IS – ISRO
TP – Third Party Inspection Agency
H – Carrying out responsibility
R – Review of records & results
W – Test/inspection to be witnessed

Signature For VENDOR

Signature For THIRD PARTY

Signature For ISRO

Date :

Place:

SL. NO.	COMPONENT/ OPERATION	CHARACTERISTICS TO BE CHECKED	METHOD OF CHECKING	CATEGORY	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	INSPECTION AGENCY			REMARKS
									VR	TP	IS	
B. WELDING PROCEDURE, WELDER'S QUALIFICATION, ETC.												
1	Welding	WPS, Welder's & Welding operator's qualification	Test piece, Visual, Physical & NDT (RT)	Critical	100%	ASME Sec IX	ASME Sec IX	WPS, PQR & WPQ	H	H	R	
C. FABRICATION (Spacer Block, Balancers, Yokes, Interconnecting structure, Bearing retainers, etc.)												
1	Setting out / Layout / Marking / CNC programming	Layout	Measurement	Major	100%	Relevant drawings	Full scale layout to be checked before cutting	Shop register	H	W	R	
2	Fitup before welding.	Quality	Visual alignment & check of major dimensions	Major	100%	Drawings	a. proper edge preparation b. proper tack welds c. minimum gap for butt joints as per WPS d. DIN-8570	IR	H	H	R	Members requiring site welding shall be match marked at joining ends for site erection
3	Welding (fillet joints)	Profile, fillet size, overall physical appearance	Visual/ gauge, DP/ MPT after final welding	Major	100%	ASME SecVIII, Vol-1	Drawings	IR	H	W	R	10% DP test at random shall be done
4	Full penetration welding	a. Root inspection after back gouging	Visual & LPI	Major	100%	IS:3658	No cracks allowed	IR	H	W	R	
		b. Internal defects	UT / RT	Critical	Wherever asked in the drawing	ASME Sec-VIII, Vol-1	ASME Sec-VIII, Vol-1	Test report	H	W	R	

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									VR	TP	IS	
		c. Welding quality, surface defects	LPI / MPI	Critical	Wherever asked in the drawing	ASME Sec-VIII, Vol-1	ASME Sec-VIII, Vol-1	Test report	H	H	R	
5	Stress relieving (after complete welding)	T-T curves	T-T curve verification	Major	100%	ASME Sec-VIII, Vol-I	Drawings	T-T graph	H	R	R	
6	Dimensional inspection after welding & stress relieving	Dimensional	Measurement of major dimensions & full size shop layout checking	Major	100%	Drawing / DIN 8570	Drawings	IR	H	H	W	
D. GRIT BLASTING & PAINTING												
1	Grit blasting & painting	Paint thickness	Visual & measurement by paint thickness gauge	Major	At random for paint thickness	Drawing & specification	Drawings & specification	IR	H	W	R	
E. MACHINING (Spacer Block, Balancers, Yokes, Axles, Interconnecting structure, Bearing retainers, etc.)												
1	Machining	Overall dimensions	Measurement & visual	Major	100%	Drawing	Drawing	IR	H	H	R	
2	Drilling, etc.	Drilling & tapping	Measurement of hole size & center distances	Critical	100%	Drawing & DIN 8570	Drawing	IR	H	H	R	

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									VR	TP	IS	
F.	SUB – ASSEMBLIES of Bogie System											
1.	Balancer with Yoke Assembly	Level, Alignment & Free Movement	Measurement, visual & Manually movement	Critical	100 %	Drawing	Drawing	IR	H	W	W	
2.	Bogie Structure on Balancer & Yoke Assembly	Level, Alignment	Measurement& visual	Critical	100 %	Drawing	Drawing	IR	H	W	W	
3.	Wheel & Axle Sub-Assembly	Level, Alignment & Free Movement	Measurement, visual & Manually movement	Critical	100 %	Drawing	Drawing	IR	H	W	W	
4.	Bogie Assembly with Wheels	Level, Alignment & Free Movement	Measurement, visual & Manually movement	Critical	100 %	Drawing	Drawing	IR	H	W	W	
G.	Control Assembly of Balancers, Yokes, Interconnecting Structure, Axles, Wheels, etc. AT SHOP											
1.	Control assembly works	Dimensions, Levels, Alignment, Erection of clits with fasteners	Visual & Measurement	Critical	100 %	Drawings	Drawings	IR	H	H	H	Before dismantling reference line & match marking to be punched. Welding of erection clits to be ensured

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SL. NO	COMPONENT/ OPERATION	CHARACTERISTICS TO BE CHECKED	METHOD OF CHECKING	CATEGORY	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	INSPECTION AGENCY			REMARKS
									VR	TP	IS	
H.	ERECTION AT SITE											
1.	Fabricated material inspection	Visual, dimensional, review of TC & IR	Visual & measurement	Major	100%	TS & approved drawings	TS & approved drawings	IR	H	R	R	
2.	Welding & welder qualification	WPS, Welder's & Welding operator's qualification	Test piece, Visual, Physical & NDT (RT)	Critical	100%	ASME Sec IX	ASME Sec IX	WPS, PQR & WPQ	H	W	R	
3.	Welding	Preheat / interpass / sequence of welding	Visual	Major	100%	Drawing & TS	Drawing & TS	IR	H	H	H	
4.	Stress relieving	T-T curves	T-T curves, charts	Critical	100%	Drawing & TS	Drawings & TS	IR	H	H	H	
5.	Complete welding	Visual, DPT, UT	Visual & UT	Major	100%	TS & drawings	TS & drawings	IR	H	H	H	
6.	Dimensional check of whole assembly	Position, level, alignment and other dimensions, clearances	Measurement & Visual	Major	100%	Drawings	Drawings	IR	H	H	H	
7.	Bogie Movement along the Track	Clearance	Visual & Measurement	Major	100%	TS & Drawings	TS & Drawings	IR	H	H	H	
8.	Assembly of MLP with Bogie	Position, level, alignment and other dimensions, clearances & Interfaces	Measurement & Visual	Major	100%	TS & Drawings	TS & Drawings	IR	H	H	H	
9.	MLP Movement with Bogie System on Straight Track by using hauler	Clearances	Visual & measurement	Major	100%	TS & drawings	TS & drawings	IR	H	H	H	
10.	MLP Movement with Bogie System on Curved Track by using Hauler	Interface	Visual & Measurement	Major	100%	TS & drawings	TS & drawings	IR	H	H	H	

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For VENDOR For THIRD PARTY For ISRO Place:

WELDING SPECIFICATION FOR SHOP AND SITE FABRICATED EQUIPMENT

1. SCOPE

This specification shall apply to shop and site fabrication of all welded joints in carbon steel, low alloy steel and stainless steel equipment like pressure vessels, tanks, columns and heat exchangers etc. The specification shall apply to all the joints indicated below:

(a) Butt joints produced by double sided welding which produce the same quality of deposited weld metal on both inside and outside weld surfaces

(b) Butt joints produced by single sided welding having backing strip which remains in place and full penetration butt weld without backing strip

(c) Corner or those joints connecting two (2) members approximately at right angles to each other in the form of L or T

(d) Partial penetration welds of the groove type which are used for connections not subjected to external loading

(e) Fillet welded joints of approximately triangular cross-section joining two (2) surfaces at approximately right angles to each other and having a throat dimension at least 70% of the thinner of the parts being joined but not less than 6 mm

(f) Welds attaching nozzles and other connections

(g) Welds which are used to join non-pressure parts like supports, lugs, brackets, stiffeners and other attachments to the vessel wall.

(h) Any other similar joint which is not specified above but may be encountered during fabrication.

2. CODES AND STANDARDS

2.1 The welding equipment, welding consumables, preheating, Post weld Heat Treatment (PWHT), other auxiliary functions and welding personnel shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment are to be fabricated and installed. Nothing in this specification shall be construed to relieve the VENDOR/CONTRACTOR of this responsibility. Specifically, the latest editions of the codes and standards listed below shall apply:

(a) ASME Boiler and Pressure Vessel Code (BPV Code), Section II Part C - Material Specifications for Welding Rods, Electrodes, and Filler Metals

(b) ASME BPV Code, Section V - Non-destructive Examination (NDE)

(c) ASME BPV Code, Section VIII Division 1- Rules for Construction of Pressure Vessels.

(d) ASME BPV Code, Section IX - Welding and Brazing Qualifications

(e) American Society of Non-destructive Testing (ASNT) SNT-TC-IA-Recommended Practice

(f) Indian Boiler Regulations (IBR)

(g) Any other codes and standards specified in Section C or data sheet A of Section D of enquiry specification

2.2 The codes and standards listed in para 2.1 forms an integral part of this specification. In the event of conflict between this specification and the codes and standards, the more stringent shall govern.

2.3 If no specific requirements are given in this specification, the requirements of the applicable code shall govern.

3. WELDING PROCESSES

The following welding processes shall be used:

3.1 GAS TUNGSTEN ARC WELDING (GTAW)

3.1.1 The root pass of single-sided groove welds without backing

3.1.2 Full penetration nozzle connection where other side is inaccessible

3.1.3 Any butt and fillet weld on equipment with thickness 5 mm or less

3.1.4 For all passes of butt and fillet welding of nozzles on equipment and integral piping of size 50 mm NB or smaller

3.2 SHIELDED METAL-ARC WELDING (SMAW)

3.3 SUBMERGED ARC WELDING (SAW)

Maximum weld deposit per pass shall be 12.7 mm for carbon steel (P-1) and 9.5 mm for other materials.

3.4 Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW) processes

3.5 Other processes such as plasma-arc and electro-slag welding may be used only with the approval of the PURCHASER and depending upon the process and application proposed. These processes may require testing in addition to that specified by the governing procedure qualification code.

3.6 Table-1 gives recommendations for welding processes to be used for carbon, low alloy and austenitic stainless steels.

4. WELDING CONSUMABLES

4.1 The VENDOR/CONTRACTOR shall provide, at no additional cost, all the welding consumables such as electrodes, filler wires, flux, oxygen, acetylene and argon etc., in order to complete the welding in all respects. The consumables shall be from reputed and approved manufacturers. All the consumables shall be approved by the PURCHASER.

4.2 The electrodes and filler wires shall be of the class specified in Table 1 Welding Specification Chart.

4.3 Electrode qualification test records shall be submitted for the PURCHASER's approval. The VENDOR/CONTRACTOR shall also submit batch test certificates from the electrode manufacturer for physical and chemical tests.

4.4 Electrodes shall be in sealed containers and adequate care shall be taken for storage, strictly in accordance with the manufacturer's recommendations.

4.5 Electrodes, which have been removed from the original containers, shall be kept in baking ovens as per the manufacturer's recommendations and, once these are taken out, shall be consumed within the time limits stipulated by the manufacturer. Care shall be taken in handling the electrodes to prevent any damage to the flux covering. Portable ovens shall be used for carrying the electrodes from the main oven to the field. Electrodes of different specifications shall be stored in different compartments of a baking oven to avoid mix up.

4.6 The electrodes, filler wires and flux used shall be free from contamination such as rust, oil, grease and such foreign matter.

4.7 Low hydrogen electrodes shall be used for weld joints in carbon steel if the wall thickness exceeds 19 mm and low alloy steel of all thicknesses except that non-low hydrogen electrodes shall be permitted for the root pass of carbon steel only.

4.8 If ultimate tensile strength of base material permits, E 6010 electrodes may be used, for root pass of butt welds and for fillet welds, in carbon steel.

5. WELDING QUALIFICATIONS

5.1 Qualification of the welding procedures to be used and the performance of welders and welding operators shall conform to the requirements of the BPV Codes and Section IX. For equipment under the purview of IBR, these shall also meet the requirements of IBR.

5.2 No production welds shall be undertaken until the qualification requirements are completed to the satisfaction of the PURCHASER.

5.3 When impact testing is required by the code or by the specification, these requirements shall be met in qualifying welding procedures.

5.4 The VENDOR/CONTRACTOR shall be responsible for qualifying any welding procedure, welders and welding operators intended to be deployed. The VENDOR/CONTRACTOR shall submit the Welding Procedure Specification (WPS) for acceptance by the PURCHASER. After approval by the PURCHASER, the procedure qualification test shall be carried out by the VENDOR/CONTRACTOR, at his own expense, duly witnessed by the PURCHASER. A complete set of test results, in specified format, shall be submitted to the PURCHASER for approval immediately after successful completion of procedure qualification test. All tests as required by the BPV code Section IX or IBR shall be carried out. The WPS shall require re-qualification, if any of the essential variables or supplementary variables is altered.

5.5 Welders and welding operators shall be qualified in accordance with BPV Code and Section IX or IBR, as applicable. The qualification shall be carried out in the presence of the PURCHASER. Only those welders and welding operators who are qualified by the PURCHASER shall be deployed on the job. For equipment under the purview of IBR, approval of the local IBR inspector shall be obtained by the VENDOR/CONTRACTOR.

5.6 Welders and welding operators shall always keep their identification cards with them and shall produce them on demand. The VENDOR/CONTRACTOR shall issue the identity cards after the same are duly certified by the PURCHASER. Welder or welding operator, who is not in possession of the identity card, shall not be allowed to work.

5.7 The VENDOR/CONTRACTOR shall use forms as per BPV code, section IX, form QW-482, form QW-483 and form QW-484. Other forms are also acceptable subject to approval by the PURCHASER.

5.8 Unless agreed otherwise, the VENDOR/CONTRACTOR shall advise the PURCHASER, in writing, at least three (3) weeks before any welder or welding operator is deployed on the work, the names and qualifications of the proposed welders, welding operators and welding supervisors. It shall be the VENDOR/CONTRACTOR's responsibility to ensure that all welders and welding operators employed by him or his SUB-VENDORS/SUB-CONTRACTORS, on any part of the work either in the VENDOR/CONTRACTOR's or his SUBVENDOR/SUB-CONTRACTOR's works or at site are fully qualified as required by the code. Each welder and welding operator shall qualify for all types of welds, positions and materials or material combinations he may be called upon to weld.

5.9 Should the PURCHASER require to qualify or requalify any welder or welding operator, the VENDOR/ CONTRACTOR shall make available, at no extra cost to the PURCHASER the men, equipment and materials for the tests. The cost of testing the welds shall be borne by the VENDOR/CONTRACTOR.

5.10 Welding supervisors shall have qualifications such as engineering degree or engineering diploma in welding technology with adequate knowledge of welding consumables, welding machines, NDE and a minimum of five (5) years of experience in supervising welding of joints.

5.11 All welding, including the tacking up of all welds shall be carried out by qualified welders and welding operators as per approved WPS. Any weld made by other than a qualified welder or welding operator or not carried out as per approved WPS shall be cut out and re-welded.

5.12 For purposes of identification and to enable tracing full history of each joint, each welder and welding operator employed on the work shall be given a designation. The welder and welding operator's designation and the date on which the join was made, shall be stamped near the relevant joint and on the relevant drawings also. Copies of the drawings so marked shall be furnished to the PURCHASER for record purposes. For austenitic stainless steels, welder and welding operator's designation shall be applied with water-proof paint or by etching or stencilling machine that is not detrimental to the metal. Alternatively, record cards may be used.

5.13 For each welder and welding operator, a record card shall be maintained showing the procedures for which he is qualified. These cards shall note the production welds, the date of the welding done, the type of defects produced and their frequency. The record shall be reviewed once in a week by the PURCHASER and those welders and welding operators whose work required a disproportionate amount of repair shall be disqualified from welding. Requalification of welders and welding operators disqualified more than three (3) times shall be entirely at the discretion of the PURCHASER. As far as possible, the qualification shall be carried out at the location (site or shop) where the actual fabrication and welding work is to be carried out.

6. PREPARATION FOR WELDING

6.1 Surfaces to be welded shall be smooth, uniform and free from fins, tears and other defects, which would adversely affect the quality of the weld. All welding faces and adjoining surfaces, for a distance of at least 50 mm from the edge of the welding groove or 12 mm from the toe of the fillet in the case of socket welded or fillet welded joints, shall be thoroughly cleaned of rust, scale, paint, oil or grease, both inside and outside.

6.2 Joints for welding shall be as per the project specifications and approved fabrication drawings.

6.3 Butt joints shall be prepared as per ASME BPV Code Section VIII Division 1, unless specified otherwise. For equipment under the purview of IBR, these shall be as per IBR. Any other end preparation which meets the WPS is acceptable.

6.4 Internal misalignment shall be reduced by trimming but such trimming shall not reduce the finished wall thickness below the required minimum wall thickness. Trimming shall not be abrupt. It shall be tapered with a minimum slope of 1:3. Root opening of the joint shall be within the tolerance limits of the WPS.

6.5 Welds shall be as per ASME BPV Code Section VIII Division 1 or in accordance with IBR for equipment under the purview of IBR.

6.6 Reinforcing pads and saddles shall have a good fit with the parts to which they are attached. A tell-tale hole shall be provided on the side of any pad or saddle to reveal leakage in the weld and to allow venting during welding and heat treatment. Pad or saddle shall be added, after the branch weld has undergone satisfactory visual and NDE.

6.7 The ends shall be prepared by machining, grinding, flame cutting or plasma cutting. Where flame cutting is used, the effect on the mechanical and metallurgical properties of the base metal shall be taken into consideration. Flame cutting of alloy steel is not advisable. If alloy steel is cut using flame, the heat affected zone shall be removed completely by grinding and/or machining Magnetic Particle (MT) or Liquid Penetrant (PT) testing shall be carried out to ensure soundness of edges. However, flame cutting of carbon steel is permitted. Wherever practicable, flame cutting shall be carried out by machine. Machine flame-cut edges shall be substantially as smooth and regular as those produced by edge planning and shall be cleaned free of slag. Manual flame cutting shall be permitted only where machine flame cutting is not practicable and with the approval of the PURCHASER, and such surfaces shall be ground or dressed to a smooth finish as required by the specification and to the satisfaction of the PURCHASER. Slag, scale or oxides shall be removed by grinding to bright metal at least two (2) mm beyond the burnt area.

6.8 Thermal cutting of carbon steel shall be performed under the same conditions of preheating and PWHT as for the welding of each class of material. However, PWHT is not required when:

(a) The heat affected zone produced by thermal cutting is removed by mechanical means immediately after cutting. However, in any case, all remaining slag, scale or oxides shall be removed by grinding to bright metal at least two (2) mm beyond the burnt area, or

(b) Thermal cutting is part of fabrication, manufacturing or erection sequence leading to a weld end preparation where welding immediately follows.

6.9 On austenitic stainless steels, plasma cutting, machining or grinding methods shall be used for edge preparation. Flame cutting is not permissible. Cut surfaces shall be machined or ground smooth after plasma cutting. Stainless steel materials shall be ground with Al_2O_3 grinding wheels and cleaned with stainless steel wire brushes.

6.10 Before fitting up the weld joint, the profile and dimensions of the weld end preparation shall be checked by the PURCHASER. If the specified tolerances are exceeded, this shall be corrected (with prior approval) by grinding, machining or any other method acceptable to the PURCHASER.

6.11 Fit-ups shall be examined by the PURCHASER prior to welding the root pass.

7. TECHNIQUE AND WORKMANSHIP

7.1 Stainless steel welding shall be carried out at a location away from carbon steel welding.

7.2 Components to be welded shall be aligned and spaced as per the requirements of the code and WPS.

7.3 Alignment and spacing shall be achieved using suitable wires to maintain the gap. These shall be removed after tack welding. The ends to be welded shall be held using suitable clamps, yokes or other devices which will not damage the surfaces in any manner. It shall be ensured that welding operations do not result in distortions.

7.4 Earthing shall be provided on the job using earthing clamps of similar material as the job. Earthing shall not be given through welding rotators.

7.5 Tack welds at the root joint, for maintaining joint alignment, shall be made only by qualified welders or welding operators and with filler metal equivalent to that used in the root pass. Tack welds shall be fused with the root pass weld, except that those which have cracked shall be removed. Peening is prohibited on the root and final passes of a weld. The required preheat shall be maintained prior to tack welding. Means shall be made available to measure preheat temperature.

7.6 No welding shall be carried out if there is any impingement in the weld area of rain, snow, excessive wind or if the weld area is wet.

7.7 Irrespective of the class of steel, root runs shall be made without interruption other than for changing the electrodes or to allow the welder or welding operator to reposition him. Root runs made in the shop may afterwards be allowed to cool by taking suitable precautions to ensure slow cooling e.g. by wrapping in a dry asbestos blanket. Welds made at site shall not be allowed to cool until the thickness of weld metal deposited exceeds one third of the final weld thickness or 10 mm, whichever is greater.

7.8 When welding alloy steels, it is strongly recommended that interruption of welding be avoided. Where such interruption is unavoidable, either the preheat shall be maintained during the interruption or the joint shall be post heated or wrapped in dry asbestos blankets to ensure slow cooling. Before recommencing welding, preheat shall be applied again.

7.9 Welded-on bridge pieces and temporary attachments shall preferably be avoided. Where approved by the PURCHASER, these may be used. Material of these shall be compatible with material with which they are temporarily welded. All such pieces shall be removed after welding of joints and the weld area ground flush. These areas shall be subjected to MT and PT examination. These pieces shall be welded by qualified welders and welding operators and with electrodes compatible with the parent material. The preheating requirements of material shall be applied and maintained during the welding of attachments. These temporary attachments shall be removed by grinding, chipping, sawing or by arc or flame gouging. When arc or flame gouging is used, at least three (3) mm of metal shall be left around the surface which shall be removed by grinding. This metal shall not be removed by hammering or by use of force.

7.10 The arc shall be struck only on those parts of parent metal where weld metal is to be deposited. When inadvertent arc-strikes are made on the base metal surfaces outside the joint groove, the arc-strikes shall be removed by grinding and shall be examined by MT and PT procedures.

7.11 Oxides shall not be permitted to form during welding or heat treatment or both, on the internal surfaces which will not be subsequently cleaned. Inert gas purging is an acceptable method to prevent such oxidation. All joints in materials which contain more than 1¼ % chromium shall be purged to assure that less than 1% of oxygen is present on the joint underside before initiation of the welding. The purging operation shall be maintained for a minimum of two (2) passes.

7.12 7.12 Argon gas used in GTAW process for shielding and purging shall be at least 99.95% pure. Purging shall be carried out at a flow rate depending on diameter until at least five (5) times the volume between dams is displaced. In no case shall the initial purging period be less than 10 minutes. After initial purging, the flow of the backing gas shall be reduced to a point where only a slight positive pressure prevails. Any dams used in purging shall be fully identified and removed after welding and accounted

for in order to avoid leaving them in the system. The rate of flow for shielding purposes shall be established in the procedure qualification.

7.13 Thorough check shall be exercised to maintain the required inter-pass temperature.

7.14 All equipment necessary to carry out the welding, for supporting of the work, for preheating and PWHT including thermal insulation for retaining the heat and for the protection of the welder and welding operator shall be provided by the VENDOR/CONTRACTOR at no extra cost. All necessary precautions shall be taken during cutting and welding operations. It shall be ensured that proper ventilation is available in the welding area and adequate protective gear such as goggles, masks, gloves, protection for the ears and body are used at all times. For guidelines refer ASME standard Z49.1, “Safety in Welding and Cutting”.

7.15 After deposition, each layer of weld metal shall be cleaned with a wire brush to remove all slag, scale and defects, to prepare for the proper deposition of the next layer. The material of wire brush shall be compatible with parent material. Stainless steel materials shall be cleaned with grinding wheels or stainless steel brushes which have not been used on other materials. Either aluminium oxide or silicon carbide grinding wheels shall be used. Special care shall be taken to secure complete and thorough penetration of the fusion zone into the bottom of the weld. It is recommended that the root run be checked by MT or PT procedures for critical equipment.

7.16 If specified, upon completion of welding, the joints shall be wrapped in dry asbestos blankets to ensure slow cooling, unless PWHT is applied immediately.

7.17 No welding or welded parts shall be painted, plated, galvanised or heat treated until inspected and approved by the PURCHASER. Welds shall be prepared and ground in such a way that the weld surfaces merge smoothly into the base metal surface, particularly for welds which are to undergo NDE.

7.18 Except where necessary to grind flush for NDE, reinforcement for butt welds may be provided. The height of such reinforcement shall meet the requirements of the code. The reinforcement shall be crowned at the centre and tapered on each side of the joined members. The exposed surface of the weld shall be ground where required to present a workmanlike appearance and shall be free from depressions below the surface of the joined members. The exposed surface of the butt welds shall be free from undercuts, overlaps or abrupt ridges or valleys and shall merge smoothly into the surface at the weld toe.

7.19 Repair of weld metal defects shall meet the requirements of the code.

7.20 Any weld repair shall be subject to the approval of the PURCHASER.

7.21 In the event of several unsuccessful repair attempts or if the PURCHASER feels that a satisfactory repair is not feasible, the joint shall be completely remade.

7.22 It is preferable to use welding rectifier or DC generator for welding of austenitic steels and while using low hydrogen electrodes.

7.23 IDENTIFICATION OF WELDS

Wherever code symbol stamps are required on carbon steel and ferritic alloy steel they shall be applied directly on to the member with low stress dotted design metal die stamps or to a small stainless steel plate especially provided for such marks. These plates shall be lightly tack welded using electrodes, of diameter three (3) mm or less, of the type specified for the material. Before making the required tack weld, the material in the immediate surrounding area shall be preheated, as required, by electric means or propane or natural gas burners. Cooling shall take place under asbestos insulation in a draft-free area. Stress relieving of these welds is not required. Steel stamping directly on the surface of alloy steel with other than low stress die stamps shall not be used.

7.24 SEAL WELDS

7.24.1 Seal welding shall be carried out by qualified welders and welding operators and in accordance with approved drawings.

7.24.2 Threaded joints that are to be seal welded shall be made without the use of thread lubricating compound. Seal weld shall cover all exposed threads.

7.25 WELD ENCROACHMENT AND MINIMUM DISTANCE BETWEEN WELDS

7.25.1 Welded joints, more specifically longitudinal welds, shall be placed not closer than 50 mm to opening or branch welds, reinforcements, attachment devices or from supports etc. In case of deviation, the PURCHASER may specify additional NDE.

7.25.2 The longitudinal welds of two adjacent components shall be staggered by at least 30^{o}. The minimum distance between welds shall be 50 mm or three (3) times the wall thickness, whichever is greater. Intersection of welds shall be avoided as far as possible. If such welds are present, they shall be subject to suitable NDE at the discretion of the PURCHASER.

8. PREHEATING

8.1 Preheating prior to tack welding, welding and thermal cutting shall be used as a means of crack prevention and improving weld reliability. The general requirements of PWHT also apply to preheating.

8.2 Preheating shall be used as per the recommendations of ASME BPV Code Section VIII Division 1. For equipment under the purview of IBR, the requirements of IBR shall govern. Preheating of austenitic stainless steels is not required, except at low ambient temperatures, in which case a minimum preheat temperature of 10^{o}C is recommended. Table 2 gives the requirements of preheating for commonly used materials.

8.3 The preheating zone shall extend 75 mm or a distance equal to four (4) times the material thickness, whichever is greater, beyond the edge of the weld.

8.4 The preheat temperature shall be measured at least 75 mm away from the weld preparation.

8.5 Where preheating is specified, welding shall continue without interruption. In case interruption cannot be avoided, preheating shall be carried out before recommencement of welding.

8.6 Oxy-acetylene preheating shall not be applied.

8.7 For preheating, fuel gas/air torches, burner systems (high velocity gas or oil burners) or electrical heating may be used either locally or in a furnace. For preheating above 250^{o}C, electric heating (resistance or inductive heating) is recommended.

8.8 Approved temperature - indicating crayons, thermocouples or digital contact or laser pyrometers shall be used to measure preheat and inter-pass temperatures. A calibration report of the pyrometers and thermocouples shall be available.

8.9 When the preheat temperature is 150oC or higher, the metal shall be maintained at or above the preheat temperature until the weld is completed.

8.10 The welding of groove welds in low alloy steels of P-3 to P-5 groups with wall thickness of 19 mm or greater may only be interrupted, provided at least 10 mm of weld metal is deposited, or 25% of the welding groove is filled, whichever is greater. If the welding is interrupted prior to the above, the weld area shall be adequately covered with insulating material to ensure slow cooling. After cooling and before welding is resumed, visual examination of the weld shall be performed to assure that no cracks are formed. Required preheat shall be applied before welding is resumed.

9. POSTWELD HEAT TREATMENT

PWHT shall meet the requirements of ASME BPV Code Section VIII Division 1. Table 3 summarises the PWHT requirements for commonly used materials. For equipment under the purview of IBR, PWHT shall be as per IBR.

9.1 GENERAL REQUIREMENTS

9.1.1 A complete automatic temperature recording shall be made of preheating and stress relieving operations. Where propane gas burners or electrical resistance coils are employed, a complete temperature record of the preheating and stress relieving operation shall be made by means of a box type potentiometer. Other means of recording temperatures are permissible subject to the PURCHASER's approval.

9.1.2 Stress relief may be local or full furnace. Local stress relief shall be performed with electric induction or electric resistance coils. Suitable gas burning equipment using natural gas or propane may be employed.

9.1.3 At no time during a stress relieving/preheating cycle shall any water or liquid cooling medium be employed.

9.1.4 Where members being joined are unequal in thickness, the dimension of the heavier section shall govern the selection of width of the heated band and the duration of the holding period shall be based on maximum weld thickness.

9.1.5 For local stress relief, using electrical methods, a minimum of two (2) thermocouples tack-welded to the surface and potentiometers shall be used on the part under at least four (4) layers of asbestos paper. The hot junctions of the thermocouples shall be located on either side of the joint at least 12 mm from the edge of the joint but no further away than 100 mm. When employing induction heating, at least six (6) turns of induction cable shall be used on each side of the weld. Induction coils shall be wrapped on top of the asbestos paper protecting the thermocouples with the first turn approximately 150 mm from the centre of the weld.

9.1.6 Local stress relief using gas torches or ring burners may be employed. However, the procedure shall be limited to small items and shall be approved by the PURCHASER.

9.1.7 The stress relieving temperature shall be maintained for a period of time proportioned on the basis of one (1) hour per 25 mm of weld thickness at the joint, but in no case less than one (1) hour.

9.1.8 For piping joints and socket welded joints, pads, bosses, branch welds and couplings, one (1) thermocouple shall be positioned at a minimum distance of two (2) pipe wall thicknesses from the weld.

9.1.9 Equipment on both sides of any joint shall be adequately supported throughout the preheating, welding and stress relieving operations to prevent distortion.

9.1.10 All heating and cooling rates shall be maintained as per ASME BPV Code and time-temperature charts from the recorder shall be made available for review and acceptance.

9.1.11 The VENDOR/CONTRACTOR shall submit a detailed written procedure for the PWHT for the approval of the PURCHASER.

9.2 CARBON STEEL

9.2.1 Welded joints in carbon steel shall be stress relieved, upon completion of the welding operation, in accordance with Table 3.

9.2.2 When local stress relief is employed, the welded joint shall be heated to a temperature of not less than 600℃. The temperature level shall be maintained between 600 and 650℃, on e (1) hour per 25 mm of weld thickness but in no case less than one (1) hour. The weld area shall then be allowed to cool undisturbed in still air to a temperature not exceeding 315℃.

9.2.3 Heating and Cooling

Carbon steels, after having reached their specific stress relief temperatures, may be cooled in the furnace or under wraps, i.e., leaving the induction coils or resistance heaters and insulation in place. This means that, at the stress relief temperatures, the power to the furnace or heating coils may be shut off and cooling takes place in the furnace or with all insulation and coils remaining on the part. For furnace stress relief, the doors of the furnace may be opened after the power is shut off, at or below 315℃. Thermocouples controlling the temperatures shall remain during the cooling cycle so that excessive cooling, if it occurs, can be observed and immediately corrected. The stress relieving coils and insulation shall only be removed after the part has cooled to below 315℃ or if stress relieved in a furnace the part may be removed from the furnace and permitted to cool in still air at a temperature not below 10℃.

9.3 ALLOY STEEL

9.3.1 Welds in alloy steel shall be stress relieved after the welding operation in accordance with Table 3. After welding, the material

shall be wrapped in asbestos and allowed to cool slowly if PWHT is not carried out immediately.

9.3.2 For full furnace stress relief of a welded assembly, the entire fabricated section shall be heated uniformly to the temperature specified. The temperature shall be maintained for a period of time proportioned on the basis of one (1) hour per 25 mm of weld thickness of the piece having the greatest weld thickness in the furnace charge, but in no case, less than one (1) hour.

9.4 AUSTENITIC STAINLESS STEEL

Welded joints in austenitic stainless steel need not be stress relieved after welding. Solution annealing shall be carried out, if specified.

10. ELECTRODES

10.1 The specification and size of the electrodes, voltages and amperages, thickness of beads and number of passes shall be as specified in the approved welding procedure or otherwise agreed in writing. Only basic coated electrodes shall be used, which deposit weld will metal having the same or higher physical properties and similar chemical composition to the members being joined. For each batch of approved brand, certificate showing compliance with the specification shall be submitted to the PURCHASER for review before being released for use. All electrodes shall be purchased in sealed containers and stored properly to prevent deterioration. As welding electrodes deteriorate under adverse conditions of storage leading to dampness in the electrode coating, they shall normally be stored in dehumidified air-conditioned rooms or in hot boxes or ovens in their original sealed containers whose temperatures shall be maintained within specified limits. The condition of electrodes shall be frequently inspected. Electrodes with damage to coating shall not be used. Electrodes shall remain identified until consumed. It is preferable to procure low hydrogen electrodes in hermetically sealed containers and preserve them without damage to the containers.

10.2 All low hydrogen electrodes, after baking as per the manufacturer's recommendations, shall be stored in ovens kept at 80 to 100℃ before being used. Recommendations of the electrode manufacturer shall be strictly followed. Until the electrodes are taken out for welding, they shall be stored in portable ovens. The electrodes shall not be exposed to open atmosphere.

10.3 For welding of all grades of steel and alloys by the GTAW process, a 2% thoriated tungsten electrode conforming to SFA-5.12-86 EWTh-2 (AWS-A5.1280, EWTh-2) classification shall be used.

10.4 All electrodes to be used on alloy and carbon steel shall conform to ASME BPV Code Section II Part C or any other equivalent code.

10.5 The type of electrodes used shall be only those recommended by the manufacturer for the use in the position in which the welds are to be made.

10.6 Current and polarity shall be maintained as recommended by the electrode manufacturer.

11. INSPECTION AND TESTING

11.1 The PURCHASER shall have free access to inspect welding or any other related operations at any time and at any stage of fabrication.

11.2 The PURCHASER may require NDE of any weld for reasons other than those given in the specification. The responsibility for the cost of such testing shall be mutually decided between the PURCHASER and the VENDOR/CONTRACTOR.

11.3 The VENDOR/CONTRACTOR shall inform the PURCHASER when the weld preparation and set-up for welding of various members selected by the PURCHASER are in progress so that the PURCHASER can inspect the assembly before welding starts.

11.4 The responsibilities of the PURCHASER's representative shall in no way reduce the VENDOR/CONTRACTOR’s responsibilities to ensure that the work is carried out in accordance with the specification.

11.5 Any examination by NDE methods shall be performed before or after PWHT based on the applicable code requirements.

11.6 For a welded branch connection and for any weld, necessary repairs and NDE shall be completed before any reinforcing pad is added.

12. EXAMINATION OF WELDS

12.1 Examination refers to the quality control functions performed by the VENDOR / CONTRACTOR during fabrication, erection and testing.

12.2 As a minimum, the following shall be examined by visual examination:

(a) Materials and components to ensure that these are as per the specification and are free from defects. If defects are noticed on “free issue” items, these shall be brought to the notice of the PURCHASER without delay.

(b) Joint preparation and cleanliness

(c) Fit-up, joint clearance, and internal alignment prior to joining

(d) Preheating as applicable

(e) Variables specified by the welding procedure, including filler material, position and electrode

(f) Condition of the root pass after cleaning - external and where accessible, internal

(g) Slag removal and weld condition between passes

(h) Appearance of the finished joint and weld dimensions

12.3 Acceptance for the visual examination shall be as per ASME BPV Code Section VIII Division 1 or IBR as applicable.

13. QUALIFICATION AND CERTIFICATION OF NDE PERSONNEL

13.1 Approved and documented NDE procedure prepared by level III personnel shall be made available.

13.2 The VENDOR's/CONTRACTOR's examining personnel shall have training and experience commensurate with the needs of the specified examinations. NDE supervisors/ examiners shall be qualified at level II or above of ASME BPV Code Section V.

13.3 The VENDOR/CONTRACTOR shall make available to the PURCHASER copies of certificates of qualification of the examiners he proposes to use for the PURCHASER's approval.

14. METHODS OF EXAMINATION

The methods of examination used, Ultrasonic (UT), Radiographic (RT), MT and PT shall be in accordance with ASME BPV Code, Section V.

15. ACCEPTANCE STANDARDS

15.1 Levels of acceptance of defects in welds shall be in accordance with ASME BPV Code Section VIII Division 1.

15.2 For equipment under the purview of IBR, the levels of acceptable defects shall be as per IBR.

16. REPAIR WELDING

16.1 All defects in welds requiring repair shall be removed by flame or arc gouging, grinding, chipping or machining. The major repairs may involve:

(a) Cutting through the weld

(b) Cutting out a portion of material containing the weld, or

(c) Removing the weld metal down to the root depending upon the magnitude of the defects.

16.2 After removing the defect, the repaired portion and adjacent area shall be examined by the same NDE methods as specified for the original weld and the same acceptance criteria shall hold good.

16.3 All the repair welds shall be made using the same or other specified welding procedures as those used in making the original welds including preheating and stress relieving if originally required.

TABLE 1
WELDING SPECIFICATION CHART FOR COMMONLY USED MATERIALS

SL. NO.	BASE MATERIAL	P. NO.	WELDING PROCESS		FILLER MATERIAL		NOTES
			ROOT	FILLER	ROOT	FILLER	
1.0	CARBON STEELS	1	GTAW	GTAW	ER 70S2 OR ER 70S3	ER 70S2 OR ER 70S3	
1.1	≤ 5 mm THICK						
1.2	> 5 mm AND < 19 mm THICK	1	GTAW OR SMAW	GTAW OR SMAW	ER 70S2 OR ER 70S3 OR E 6010	E 6013 F6--EL8 OR E 7018 F7--EL12	
1.3	≥ 19 mm THK	1	GTAW OR SMAW	GTAW OR SMAW	ER 70S2 OR ER 70S3 OR E 6010	E 7018 F7--EL12	1
2.0	LOW ALLOY STEELS	4	GTAW	GTAW	ER 80S B2	ER 80SB2	
2.1	1¼% Cr ½% Mo ≤ 5 mm THICK						
2.2	1¼% Cr ½% Mo > 5 mm THICK	4	GTAW	SMAW	ER 80SB2	E 8016 OR E8018-B2	
2.3	2¼% Cr 1% Mo £ 5 mm THICK	5	GTAW	GTAW	ER 90SB3	ER 90S B3	2 TO 7
2.4	2¼% Cr 1% Mo > 5 mm THICK	5	GTAW	SMAW	ER 90SB3	E 9015 OR E 9016 OR E 9018-B3	2 TO 7
3.0	AUSTENITIC STAINLESS STEELS	8	GTAW	GTAW for ≤ 5 mm THICK	ER 308 (ER 308L)	ER 308 (ER 308L)	2 TO 7
3.1	TYPE 304 (304L)			SMAW for > 5 mm THICK		E 308 (E 308L)	
3.2	TYPE 316 (316L)			GTAW for ≤ 5		ER 316 (ER 316L)	

		8	GTAW	mm THICK	ER 316 (ER316L)		2 TO 7
				SMAW for > 5 mm THICK		E 316 (E 316L)	
3.3	TYPE 321	8	GTAW	GTAW for ≤ 5 mm THICK	ER 321 OR ER 347	ER 321 OR ER 347	2 TO 7
				SMAW for > 5 mm THICK		E 321 OR E 347	
4.0	STAINLESS STEEL TO CARBON STEEL	8 to 1	GTAW OR SMAW	SMAW	ER 309 OR E 309	E 309	
4.1	SS 304/321						
4.2	SS 316	8 to 1	GTAW OR SMAW	SMAW	ER 309 Mo OR E 309 Mo	E 309 Mo	
4.3	SS 304L	8 to 1	GTAW OR SMAW	SMAW	ER 309L OR E 309L	E 309L	
4.4	SS 316L	8 to 1	GTAW OR SMAW	SMAW	ER 309 MoL OR E 309 MoL	E 309 MoL	

NOTES

1. Low hydrogen electrodes shall be used for critical systems such as chlorine, hydrogen, caustic and similar toxic inflammable fluids and also whenever the wall thickness exceeds 19 mm.
2. The argon shielding gas flow rate shall not be less than 0.34 M^3/Hr.
3. For purging and shielding argon gas shall be used. However, nitrogen may be used as an alternative to argon for purging purpose only. In case of stainless steel, nitrogen may be used where corrosion resistance is not critical.
4. For fillet welds, SMAW may be used instead of GTAW for thicknesses above 5 mm.
5. For GTAW, electrode shall be 2% thoriated tungsten.
6. Initial purging prior to welding process shall be a minimum of five (5) times the volume between dams or ten minutes minimum whichever is

higher. When welding commences, the purge gas flow shall ensure that the gas pressure is only marginally higher than atmospheric pressure to ensure no root concavity.

7. Back purging using argon/nitrogen shall be maintained for the root run and a minimum of one (1) additional pass.

8. Electrodes and filler wires manufactured by reputed firms duly approved by the PURCHASER shall only be used.

9. Electrodes shall have at least the same or higher physical properties and similar chemical composition to the members being joined.

10. Read the table in conjunction with para 3.0

TABLE-2
PREHEAT REQUIREMENTS

SL. NO.	BASE MATERIAL	P. NO.	NOMINAL WALL THICKNESS , mm	SPECIFIED MINIMUM TENSILE STRENGTH , mPa	RECOMMENDED MINIMUM PREHEAT TEMPERATURE, °C
1.	CARBON STEEL	1	≤ 25	490	10
2.	CARBON STEEL	1	> 25	490	100
3.	LOW ALLOY STEEL - 1¼% Cr ½% Mo	4	ALL	ALL	149
4.	LOW ALLOY STEEL - 2¼%Cr 1% Mo	5	ALL	ALL	210

TABLE 3

POSTWELD HEAT TREATMENT REQUIREMENTS (FOR COMMONLY USED STEEL MATERIALS)

SL. NO.	BASE MATERIAL	P. NO.	NOMINAL WALL THICKNESS mm	METAL TEMPERATURE RANGE °C
1.	CARBON STEEL	1	≤ 32	NONE
2.	CARBON STEEL	1	> 32	600 TO 650
3.	LOW ALLOY STEEL 1¼% Cr ½% Mo	4 GR 1 AND 2	ALL	600 TO 650
4.	LOW ALLOY STEEL 2¼% Cr 1% Mo	5A GR 1	ALL	680 TO 700
5.	AUSTENITIC STAINLESS STEELS	8, 9	ALL	NOTE 3

NOTES:

1. In IBR systems, in carbon steels, PWHT is also required, when the carbon percentage exceeds 0.25%, at the temperature range of 600 +/- 20℃.
2. For all low alloy steel welds under the purview of IBR, the PWHT shall be carried out at the temperature range of 620 to 660° C for 1 1/4% Cr 1/2% Mo steels and at a range of 660 to 750℃ for 2 1/4% Cr 1% Mo steels.
3. Solution annealing shall be carried out after welding of austenitic stainless steel as per the applicable services.

For equipment in carbon steels or alloy steels and meant for lethal service, PWHT of all welds shall be carried out.

SCHEDULE OF PRICES (UN PRICED COPY) & GENERAL PARTICULARS

1. Bidders shall not alter the contents of this schedule of prices. If the bidder wants any additions / alterations, these shall be brought out separately in the format as given in this schedule of prices.
2. Equipment and material to be supplied and erected shall be in accordance with section A, B, C & D of this specification.
3. The quantities indicated are an order of magnitude only. In case there is any variation in the quantities of items actually supplied from the quoted quantities, the price of the same shall be adjusted based on the unit rates furnished by the bidder for sl.no 1, 2 & 3 only.
4. The quoted price shall be price in Indian Rupees for supply of material, manufacture, inspection and testing at manufacturer's works, packing, forwarding, transportation from place of manufacture to site, transit insurance, unloading / receipt at site, storage / handling at site, erection, testing, commissioning and carrying out performance test at site inclusive of all taxes and duties as applicable indicated in the price bid.
5. Total price towards bought out items shall be indicated separately in the price bid and shall be firm and fixed.
6. During execution of works, if required, addition / deletion of the works will be carried out and such variation is limited to ± 15% of the total order quantity. The unit rates quoted shall be firm and fixed and shall be valid for the quantity variation of ± 15%.
7. Total price towards Erection and commissioning shall be indicated separately in the price bid and shall be firm and fixed for the quantity variation of ± 15% also.
8. Total price towards Third Party Inspection (to be borne by the supplier) shall be indicated separately in the price bid and shall be firm and fixed for the quantity variation of ± 15% also.
9. SDSC SHAR reserves right to place order in full or part of the scope.

Schedule of Price

S. no.	Item	Unit	Qty.	Unit Cost (Rs)	Total Cost (Rs)	GST (%)	GST (Rs)	Total Cost (Rs)
1	Procurement, fabrication, stress relieving, machining, control assembly, transportation, handling & storage at site of fabricated structural steel / Mild steel conforming to IS:2062 & IS:808 (Grade E250) items with machining as per specification enclosed with this tender.	t	16					
2	Procurement, fabrication / machining, heat treatment, control assembly, transportation, handling & storage at site of forged steel conforming to ASTM A668 (class F) and Carbon Steel IS 2004 (class 2A) as per specification enclosed with this tender.	t	17					
3	Procurement, fabrication / machining, heat treatment, control assembly, transportation, handling & storage at site of steel conforming to ASME SA517 (Grade F) as per specification enclosed with this tender.	t	22					
4	Procurement, fabrication, transportation, handling & storage at site of fabricated structural steel / Mild steel conforming to IS:2062 & IS:808 (Grade E250) items as per specification enclosed with this tender.	t	5					
5	Procurement, Sub-assembly, Control assembly, transportation, handling & storage at site of all bought-out items mentioned in the specification.	Lump-Sum	1					
6	Erection and commissioning of wheel bogie system including storage / handling at site, erection, testing, commissioning and carrying out performance test of wheel bogie system as per specification enclosed with this tender.	Lump-Sum	1					
7	Third party Inspection charges for Wheel bogie system	Lump-Sum	1					
8	Total Cost: (1+2+3+4+5+6)							

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

DATE _____

SEAL OF THE COMPANY

VENDOR PRE-QUALIFICATION CRITERIA

1. PRE-QUALIFICATION CRITERIA

Bidders shall meet the following pre-qualification criteria. Offer of the bidders which are not meeting the following criteria will not be considered for evaluation. Bidder shall submit the questionnaire given in the **Annexure-F1 to F11** of this document.

A. Technical Qualification Requirements

The bidder shall meet the following technical qualifying requirements and shall submit relevant certificates to establish his credentials.

1. Bidder shall be an organization with long experience (more than Five years) in having executed contracts for manufacture, supply, erection, testing and commissioning of heavy structural works using structural built-up sections.
2. The firm shall have successfully completed Manufacture, Installation, testing and commissioning of heavy structural works of the order during last 5 years ending with 31.03.2018.

   One Heavy structural work of 50t
   or
   Two heavy structural works of 30 t

Bidders have to provide relevant certificates, purchase orders and amendments etc. to the values along with the Techno-Commercial Bid, without which the offer will be summarily rejected.

3. The firm shall have the experience of procuring and assembling of forged steel wheels of vertical load capacity 100t (minimum) of 1m diameter (minimum) and shall have experience of carrying out precision assembly of bearings in the wheels/rotating elements in a single system. Purchase orders or relevant proof shall be submitted.
4. The firm shall have facilities for fabrication and handling big structural items of 10m long and 10m wide for fitment, alignment, welding, etc.
5. The firm should have successfully completed forging or machining or sum of forging + machining of steel of minimum quantity of 40t for a single system to the satisfaction of any of the reputed third party inspection agencies like M/s. MECON, M/s. M N Dastur, M/s. Lloyds, M/s. DNV, M/s TCE. Purchase orders or relevant proof shall be submitted.

B. Financial Qualification Requirements

1. The Bidder's average annual financial turnover shall be not less than Rs 5 crores per year during last three financial years ending with 31.03.2018.
2. During Last 5 Years ending 31.03.2018, the bidders should have successfully completed either of the following:

   One completed single work of heavy fabrication work not less than Rs. 3.20 crores

or

Two completed works of heavy fabrication work with each not less than Rs. 2.40 crores

3. Current financial year Solvency certificate from a scheduled bank for Rs. 1.60 crores or above.

C. Documents to be submitted along with the bid submission

1. Firm establishment certificate and nature of work.
2. Details of work similar type completed during the last 5 years ending with 31.03.2018. (for SI. Nos. 2 & 3 of A)
3. Satisfactory work completion certificates from the clients, with the work order copies (for SI. Nos. 2& 3 of A)
4. The Bidders PAN, GST Registration No.
5. The Bidders shall submit Profit & Loss Accounts, Balance Sheets duly certified by the auditor and IT returns for the last three financial years with acknowledgement from IT Department up to last 3 years. Necessary documents shall be submitted.
6. IT/ TDS certificate shall be submitted for last three years.
7. Structure and Organization chart of the company.
8. List if personnel with qualification & experience in the firm in the areas of design, production, quality, safety, administration etc.,
9. List of Machinery & Equipment's to be used for the work

D. Bid Selection Procedure and Process of Pre –Qualification

1. Short listing based on documents submitted, satisfying the all eligibility criteria given above by the firm or individual along with their Bid / application. (Non – submission of any document as given in above list within stipulated time leads to rejection of Bid).
2. Subsequently Bidder's competency, their technical achievements and financial status will be evaluated suitable for this this project. Feedbacks from Bidder's clients will be verified.
3. Visit to sites by technical team (ISRO or Third party) where Bidder has established facilities for above mentioned works.
4. If required, visit will be made to their factory/ firm by technical team (ISRO or third party) for accessing the capability of manufacturer.

   Scrutiny of all technical specification and supply conditions mentioned in techno-commercial bid.

SCHEDULE OF GENERAL PARTICULARS / VENDOR EVALUATION FORMAT

S.n	Description	
1.	**Name of the Bidder / Manufacturer**	
2.	Address of the Bidder / Manufacturer	
3.	Type of Company Proprietary/Pvt.Ltd/Public Ltd/Joint Venture	
4.	Registration number	
5.	Year of inception of the company	
6.	Registered address	
7.	Name & address of the office of the Chief Executive of the company	
8.	Name & Designation of the officer of the Bidder to whom all correspondence shall be made for expeditious technical/ commercial co-ordination.	
9.	Telephone number Fax number E-mail address	
10.	Locations of the Branches of Company (if any)	
11.	Annual turn-over of the company for the last three years	
12.	IT returns for the last 3 years	
13.	Major customers (Enclose copies of the Purchase Orders)	
14.	Any customers feedback on the services which is in writing (Pl. enclose copies)	
15.	Quality certification of the company	
16.	PAN Card Copy	
17.	The Profit & Loss Account details for the last 3 years which is duly audited and Submitted as part of the Annual Report	
18.	Orders executed during last three years, > 30t or > Rs. 3.20 crores, references are is to be mentioned. (Separate sheet can be attached).	
19.	The firm shall have the experience of procuring and assembling of forged steel wheels of vertical load capacity 100t (minimum) of 1m diameter (minimum) and shall have experience of carrying out precision assembly of bearings in the wheels/rotating elements in a single system.	
20.	Shop floor area covered	
21.	No. of employees (Supplier shall mention contract personnel separately) Engineers Supervisors Technicians Quality control engineers Administrative Staff.	
22.	Handling facility available: Over head / Gantry Crane details (Capacity , span lift). Mobile Cranes.	
23.	Load testing facility Available: Maximum weight available. No. of weights Total test load available.	
24.	Welding / fabrication workshop (Type / capacity / quantity of machines shall be provided)	

	MMAW machines GMAW machines Gas cutting machines Plasma cutting machines Welding Fixtures		
25.	No. of Welders (MMAW), Qualification details, No. of Welders (GMAW), Qualification details, No. of Welders (TIG), Qualification details, Welders Qualified by:		
26.	Details of welding Inspection Equipment & Welding inspector available with supplier (LPT, UT, MPT, Xray, etc)		
27.	Forming facilities available (with brief specification of each machine Shearing Machine Cutting Machine Cutting Machine Bending Machine		
28.	Machining Facilities available (with brief specification of each machine) Turning lathe (Conventional /CNC) Milling Machine (Conventional / CNC) Gear Cutting / Hobbing Machines Drilling Machines (conventional / CNC) Cylindrical Grinding Machine (Conventional / CNC) Any other machines		
29.	Details of inspection facilities / Instruments available (Brief description & specifications shall be provided)		
30.	If third party Inspection Services are taken for fabricating similar works give details.		
31.	Design Software's available Drafting & modeling software packages FEM software Other softwares Design Engineers (with qualification & experience		
32.	Bid validity period (Min. 4 months from date of bid opening)		
33.	COMPLETION SCHEDULE	Period required for trial run of wheel bogie at supplier site (from the date of LOI)	_____ Months
		Period required from assembly, testing and commissioning at department site (from the date of LOI)	_____ Months

SIGNATURE :

NAME :

SEAL OF THE COMPANY DESIGNATION :

COMPANY :

DATE :

EXCEPTIONS AND DEVIATIONS

In line with Proposal Document, Bidder may stipulate Exceptions and deviations to the proposed conditions if considered unavoidable.

Sl.no	Reference in Specification	Dept. Specification	Offered specification	Deviation

NOTE:

- Only deviations are to be written in the above form.
- Any deviations taken by the Bidder to the stipulations of the Proposal document shall be brought out strictly as per this format and enclosed along with the bid.
- Any deviations not brought out in this Proforma and written elsewhere in the Proposal document shall not be recognized and the same is treated as null and void.
- Any wilful attempt by the Bidders to camouflage the deviations by giving them in the covering letter or in any other documents that are enclosed may render the Bid itself non-responsive.

SCHEDULE OF TIME FOR MANUFACTURE, DESPATCH AND SHIPMENT TO

Equipment	Time for manufacture from date of LOI / PO (in Weeks)	Time for tests at works, dismantling, packing and ready for despatch from works (in weeks)	Time for shipment to site (in weeks)	Total time from date of LOI / PO to shipment to site.
1	2	3	4	(1 + 2 + 3 + 4)

The Bidder hereby undertakes to meet the above time schedule from the date of LOI / PO

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

DATE _____

SEAL OF THE COMPANY

SCHEDULE OF BIDDERS EXPERIENCE

The bidder shall furnish here under a list of STRUCTURAL works executed by him to whom a reference may be made by the PURCHASER in case the PURCHASER considers such a reference necessary.

SL. NO.	Name & address of Client / Name & address of project or plant (incl. tel.no., fax no., e-mail and name & designation of person who can be contacted.	Purchase Order / Contact no. and Date.	Brief details of equipment / system covered	Scope of services	Contract price (Rs)	Scheduled date of completion	Actual date of completio	Reasons for delay in completion, if applicable.	REMARKS

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

DATE _____

SEAL OF THE COMPANY

DATA TO BE FILLED ALONG WITH THE BID FOR SUPPLY & COMMISSIONING OF WHEEL BOGIE SYSTEM

SR. NO.	DESCRIPTION	TENDERS OFFER
1.	Confirm that the system shall be realised as per technical specification, approved manufacturing drawings, bill of material to meet the functional requirement.	Yes / No
2.	Confirm that all the electrical items (motors, limit switches, local control panels, cables) shall be procured as per specification and to be erected tested & commissioned at site.	Yes / No
3.	Confirm that all the bought out items are to be procured as per the specification from the approved parties	Yes / No
4.	Confirm that all the bought out items are to be inspected at the inspected by TPIA / Departmental representative at Vendors shop before reaching to manufacturer's shop	Yes / No
5.	Confirm that fabrication of all items shall be done as per IS:800 & tolerance in fabrication shall be maintained as specified in relevant drawings.	Yes / No
6.	Confirm that all sub-assemblies shall be tested for proper functioning, free running, bearing noise etc. & shall be brought to site in grease packed condition.	Yes / No
7.	Confirm that all the items shall be painted asper painting scheme.	Yes / No
8.	Erection sequence shall be submitted along with offer.	Yes / No
9.	Manufacturing schedule & Erection schedule shall be submitted along with offer.	Yes / No
10.	Resources planning shall be submitted along with offer	Yes / No
11.	Man power planning for erection shall be submitted along	Yes / No
12.	Confirm that all the through bolts required for erection of subassemblies will be supplied.	Yes / No
13.	Confirm that testing and commissioning of the total system shall be carried out as per specification.	Yes / No
14.	Confirm that QAP for fabricated items, machined items, Subassemblies and for total bogie system in assembled condition shall be submitted for approval.	Yes / No
15.	Confirm that during execution of works, if required addition / deletion of the works will be carried out and such variation is limited to ± 15% of the total order quantity. The unit rates quoted shall be valid for the quantity variation of $\underline{+}$ 15%	Yes / No
16.	The rates quoted for the erection, commissioning and Third party inspection are fixed and shall be valid even for a quantity variation of $\underline{+}$ 15%.	Yes / No

CHECK LIST

S.no	Description	Response by supplier
1	All documents related to Prequalification criteria mention in Section F2 have been met and all related documents are enclosed in technical Bid	Yes / No
2	Demand Draft towards the Tender fee and Earnest Money Deposit are enclosed in technical bid and scan copy is uploaded in e-procurement portal.	Yes / No
3	The detailed scope of work and technical specifications are understood and price was quoted accordingly.	Yes / No
4	Confirmation that the quoted prices are firm and fixed till the completion of scope of work.	Yes / No
5	Validity of Offer is 4 months (minimum).	Yes / No
6	Vendor Evaluation Format is attached	Yes / No
7	GST at the prevailing rates for (If not mentioned it will be assumed that the price quoted are inclusive of taxes).	Yes / No
8	Delivery Schedule with milestones	Yes / No
9	Accepted the Department Payment Terms	Yes / No
10	Are General terms and Conditions of Contract for Supply & Erection included in proposal acceptable?	Yes / No
11	If not acceptable, are the deviations brought out in the "Schedule of Deviations"	Yes / No
12	Are there any deviations from enquiry technical specifications?	Yes / No
13	If there are technical deviations, are these filled in "Schedule of Deviations from Tech. Specifications"?	Yes / No
14	Warranty for the fully commissioned and accepted system is 12 months	Yes / No
15	10% of the Order Value shall be submitted as Security Deposit for the performance of the contract along with acceptance of order letter, which is valid till acceptance of the system.	Yes / No
16	10 % of the Order Value shall be submitted as Performance Bank Guarantee, which is valid till completion of the warranty period plus 3 months claim period.	Yes / No
17	Liquidated Damages (Ref. Clause 27 of Section A.) are acceptable	Yes / No
18	Last three years audited financial results are enclosed	Yes / No
19	Registration certificate of the company is enclosed	Yes / No
20	All the forms in Section F1 to F11 are filled	Yes / No
21	Are all data sheets A/B duly filled in and submitted in offer	Yes / No
22	Technical documents / drawings are attached along with technical bid	Yes / No

23	Section F1 & F9 unpriced copy enclosed along with technical-unpriced bid.	Yes / No
24	Section F1 & F9 filled in e-procurement Price Bid form only.	Yes / No

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

DATE _____

SEAL OF THE COMPANY

BREAK-UP IS TO BE GIVEN FOR SUPPLY COST OF THE BOUGHTOUT ITEMS

Sl. No.	Components	Specification	Unit	Qty	Unit Cost	Total cost
1.	Wheel (with Double flange)	Diameter : 1000 mm Vertical load Capacity : 100 T (minimum) Lateral Load Capacity : 20 T (minimum)	Nos	11		
2.	Single Row Taper Roller Bearing	Type : EE224115/ 224204 Outer Diameter : 520.70 mm Inner Diameter : 292.10 mm Width : 107.95 mm Make : TIMKEN	Nos	18		
3.	Spherical roller bearing	Type : 23076 CC/W33 Outer Diameter : 560 mm Inner Diameter : 380 mm Width : 135 mm Make : SKF	Nos	5		
4.	Spherical roller bearing	Type : 23088 CA/W33 Outer Diameter : 650 mm Inner Diameter : 440 mm Width : 157 mm Make : SKF	Nos	5		
5.	Spherical roller thrust bearing	Type : 29352E Outer Diameter : 420 mm Inner Diameter : 260 mm Width : 95 mm Make : SKF	Nos	5		
6.	Rail Clamp	Model No.: VZM -2 (with Floating Housing type SG-VZM-2) (Rail Clamp shall be suitable for mounting on Rail type MRS 85) Make : RÖMER Födertechnik Gmbh	Nos	2		
7.	Hydraulic jacks & power pack system	Capacity : 300 T Stroke : 150 mm Type : Double acting Hydraulic type Jacks: 6 Power pack systems: 2	Set	1		

		Along accessories mentioned in Section : C2 Make : a) Europress				
8.	3 Phase flame proof distribution panel with LDB, PDB, UPS, hydraulic jack supply incoming with outgoings	FCG Flame proof control pvt ltd, baliga, Stahl	Set	1		
9.	LED flame proof light fittings	FCG Flame proof control pvt ltd, baliga, Stahl	No.	12		
10.	Flame proof warning light fittings	FCG Flame proof control pvt ltd, baliga, Stahl	No.	8		
11.	Flame proof Annunciator	FCG Flame proof control pvt ltd, baliga, Stahl	No.	2		
12.	Flame proof sockets Single phase	FCG Flame proof control pvt ltd, baliga, Stahl	No.	4		
13.	Flame proof sockets 3 phase	FCG Flame proof control pvt ltd, baliga, Stahl	No.	2		
14.	PLC Panel including software and hardware as mentioned in Section C4	PLC system: Siemens/Schiender	Set	1		
16.	Miscellaneous items (general wiring items, armoured Cu power cables, control cables, installation accessories, cable trays & accessories etc.)	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard PATNY / INDIANA / PROFAB / ASIAN / GLOBE	Lumpsum	1		
17.	MCBs / ELMCB/RCBOs	Legrand, L&T, Siemens, ABB, Schneider	Lumpsum	1		
18.	GI Conduits & accessories, cable trays (separate trays for power and control)	Toshniwal, Steel kraft, Vimco, TATA, Jindal, Adharsa, JPC	Lumpsum	1		

SCHEDULE FOR PERFORMANCE GUARANTEES

The BIDDER shall furnish Performance Guarantees as listed below based on the requirements specified in Section C of this Specification:

1. Centre to centre distance between any two adjacent Bogies shall be within **$7500^{\pm 1}$** mm**.**
2. Squareness of the Bogie system (i.e. The difference in the two Diagonal Centre to Centre distances of the Bogies) shall be within **2 mm.**
3. Distance from top of Rail to top surface of Bogie System shall be within **$2040^{\pm 0.5}$ mm**.
4. The Bogie Wheels shall be of 1000 mm diameter and shall have a Vertical load capacity of 100 t (minimum) and Lateral load capacity of 20 T (minimum).
5. All dimensions and elevations specified in drawing of bogie system shall be achieved within the specified tolerance limits as per drawing.

SIGNATURE : _____

NAME : _____

DESIGNATION: _____

SEAL OF THE COMPANY DATE : _____

SCHEDULE FOR SUB-VENDORS

1.0 **GENERAL**

1.1 This section provides details of the Approved Vendors / Approved makes for bought-out items, which form a part of this enquiry package.

1.2 BIDDER shall clearly indicate the makes of all bought-out items and shall at no point in time during execution deviate from those indicated in the offer document.

1.3 The CONTRACTOR shall suggest and provide better makes after taking prior approval of the PURCHASER during execution of contract.

2.0 **LIST OF APPROVED VENDORS / MAKES**

2.1 WHEEL

a) MG – VALDUNES, FRANCE

2.2 BEARINGS

a) SKF
b) TIMKEN

2.3 RAIL CLAMP

a) ROMER Födertechnik GmbH, Germany

2.4 FASTENERS

a) UNBRAKO
b) TVS

2.5 THIRD PARTY INSPECTION AGENCY

a) LLOYDS INSPECTION AGENCY
b) M.N. DASTUR & Company (P) Ltd.
c) BUREAU VERITAS
d) MECON
e) TCE

2.6 PAINTS

(a) Ms. Berger Paints
(b) Ms. Asian Paints
(c) Ms. Bombay Paints
(d) Grand Polycoats

2.7 HYDRAULIC JACK & POWER PACK SYSTEM

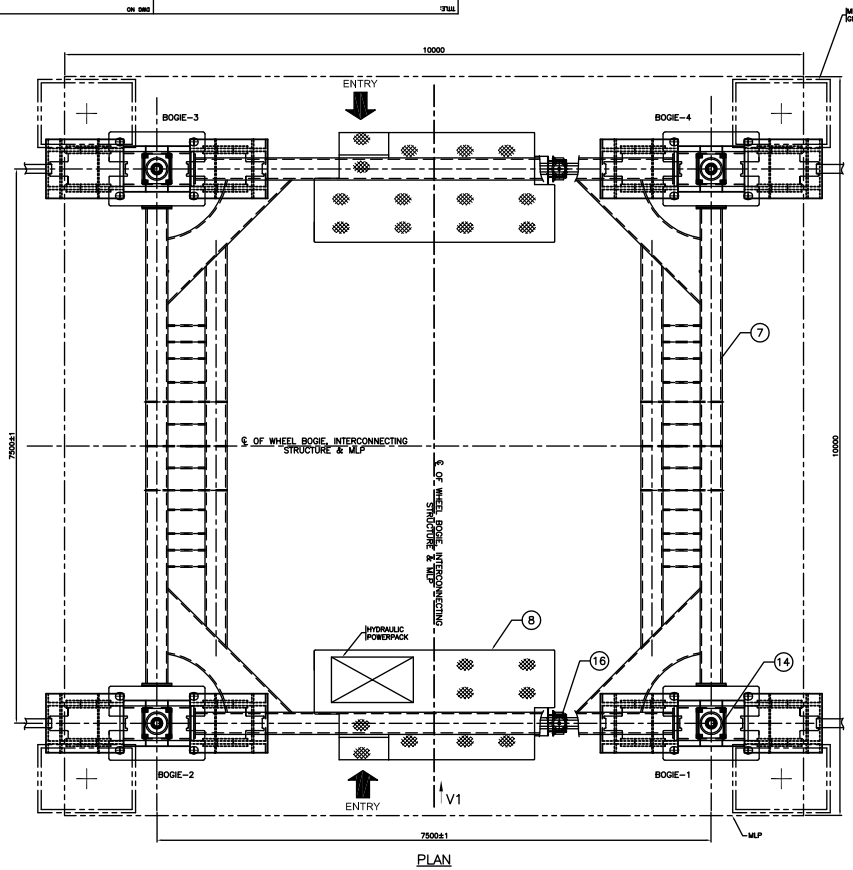
a) Europress

2.8 ELECTRICAL SYSTEMS

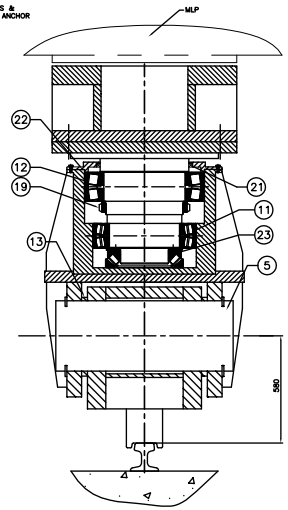
Sl No	Item	Subgroups	Recommended brands/makes
A	**General wiring Items**		
1		FRLS Wiring wires	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard
2		Flexible multi core cables	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard
3		Switch/Socket etc	FCG Flame proof control pvt ltd, baliga, Sthal
4		MCBs / ELMCB/RCBOs	Legrand, L&T, Siemens, ABB, Schneider
5		LDBs/PDBs	FCG Flame proof control pvt ltd, baliga, Sthal
6		GI Conduits & accessories	Toshniwal, Steel kraft, Vimco**,** TATA, Jindal,Adharsa, JPC
B	**Power cables**	Armoured Cu	Finolex, NICCO/ Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, /RPG/ TORRENT CABLES LTD
C	**Flame Proof Light Fitting**		FCG Flame proof control pvt ltd, baliga, Sthal
D	**Local Control Panel**		
1		MCCB	Legrand, L&T, Siemens, ABB, Schneider
2		Power /control contactors	Legrand, L&T, Siemens, ABB, Schneider
3		Selector/Control switches	AREVA T&D /JYOTI /KAYCEE INDUSTRIES LIMITED/LARSEN & TURBO LIMITED /SIEMENS LIMITED
4		Connectors	Elmex/ Connect Well/Phoenix/Wago
5		LED indication Lamps	Bhartia industries limited/ controls & switchgears co.limited/larsen & turbo limited/siemens /schneider electric india (p)/essen deinki /esbee/Binay/Jai balaji/vaishno
F	**Installation accessories**		
1		Cable jointing accessories Heat shrinkable	RAYCHEM
2		Cable Lugs	COMET / BRACO /JAINSON/ Billets Elektro werke ltd/ MULTI PRESSINGS/USHA MARTIN
3		Cable glands/plugs	FCG Flame proof control pvt ltd, baliga, Stahl
G	**Cable trays & accessories**		PATNY / INDIANA / PROFAB / ASIAN / GLOBE
		Control transformers	AE, Kappa
F	**Other system**		
		PLC Panel including software and hardware as mentioned in Section C4	PLC system: Siemens/Schiender
		Miscellaneous items (general wiring items, armoured Cu power cables, control cables, installation accessories, cable trays & accessories etc.)	Finolex, Polycab, KEI, Havells, Universal, RR Kabel, CCI, Paramount, Apar, VGuard PATNY / INDIANA / PROFAB / ASIAN / GLOBE

TITLE: BOGIE CONCEPT

DWG NO: TCE.10977A-ME-859-GA-0010(SH1OF2)



PLAN



SECTION S1S1
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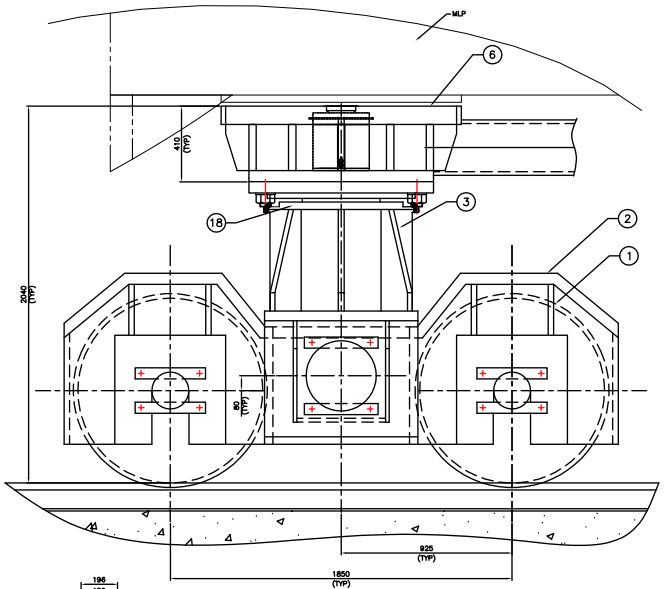

DETAIL D1
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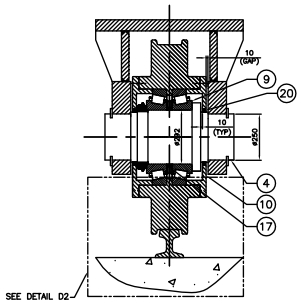

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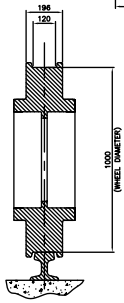
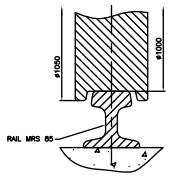


SECTION DETAIL OF WHEEL
(BALANCER, AXLE AND BEARINGS NOT SHOWN)
(SCALE 1:10)



DETAIL D2
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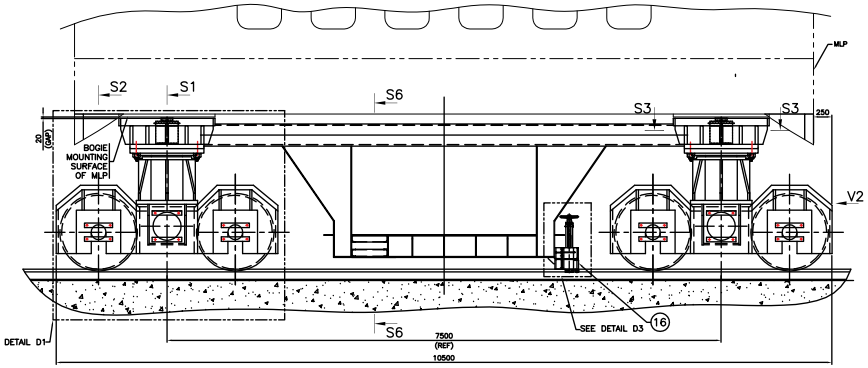
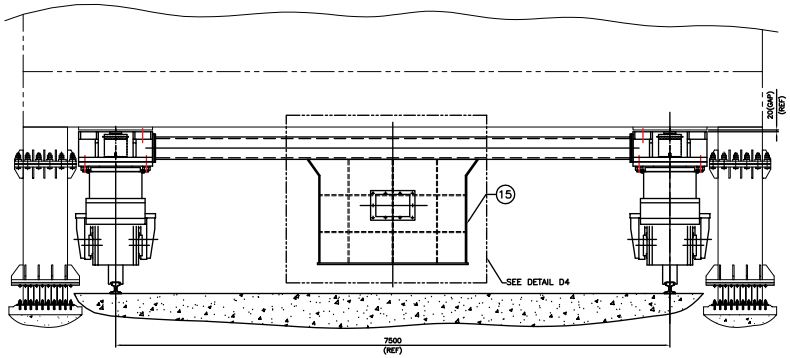


VIEW V1



VIEW V2

BILL OF MATERIAL

PART NO	DESCRIPTION	QTY	REMARK
1	WHEEL	8	
2	BALANCER	4	
3	YOKE	4	
4	AXLE	8	
5	HINGE PIN	4	
6	SPACER BLOCK	4	
7	INTERCONNECTING STRUCTURE	4	
8	MAINTENANCE PLATFORM	2	
9	SINGLE ROW TAPER ROLLER BEARING EE2214115/224204	16	
10	BEARING RETAINER	16	
11	SPHERICAL ROLLER BEARING SKF 23076 CC/W33	4	
12	SPHERICAL ROLLER BEARING SKF 23088 CA/W33	4	
13	SPACER FOR HINGE PIN	8	
14	HYDRAULIC JACK	4	
15	HAULER INTERFACE	2	
16	PARKING BRAKE / RAIL CLAMP	2	
17	PRELOAD LIMITING SPACER	8	
18	BEARING COVER FOR YOKE	2	
19	LOCK NUT SKF HM3084	4	
20	FELT SEAL	16	
21	OIL SEAL	4	
22	"O" RING	4	
23	SPHERICAL ROLLER THRUST BEARING SKF 29352E	4	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THIS DRAWING SHOWS THE CONFIGURATION OF BOGIE SYSTEM.
3. QUANTITIES SHOWN IN THE BILL OF MATERIAL ARE FOR ONE WHEEL BOGIE SYSTEM ONLY.
4. THIS DRAWING IS ISSUED FOR TENDER PURPOSE ONLY. HENCE, ALL DETAILS REGARDING FITS AND TOLERANCES, WELDS, FASTENERS, ETC. ARE NOT SHOWN IN THIS DRAWING.
5. REFER TENDER DOCUMENT FOR THE PROPOSED MATERIALS TO BE USED FOR VARIOUS COMPONENTS OF BOGIE SYSTEM.
6. THE BIDDER IS EXPECTED TO SELECT THE BOUGHT OUT COMPONENTS OF REPUTED MANUFACTURERS DULY APPROVED BY THE PURCHASER.
7. ALL THREADED FASTENERS SHALL BE TORQUED TO APPROPRIATE TORQUE VALUES.
8. WIRE LOCK THREADED FASTENERS.
9. WHEREVER WIRE LOCKING OR OTHER METHODS OF LOCKING ARE NOT FEASIBLE, LOCK WITH LOCTITE GRADE-CV. APPLY LOCTITE ON FASTENER THREADS ONLY. NO LOCTITE SHALL BE APPLIED ON THE HEAD SEATING SURFACE.
10. WHEREVER LOCTITE IS USED, NO OTHER LUBRICANT SHALL BE USED ON FASTENER THREADS OR HEAD SEATING SURFACES.
11. WHEREVER LOCTITE IS NOT USED, LIGHTLY LUBRICATE FASTENER THREADS AND HEAD SEATING SURFACES WITH MOLYKOTE-G GREASE.

DO NOT SCALE | FOR TENDER PURPOSE

INDIAN SPACE RESEARCH ORGANISATION
SATISH DHAWAN SPACE CENTRE, SHAR

TATA CONSULTING ENGINEERS LIMITED
MUMBAI

PROJECT: PSLV INTEGRATION FACILITIES

TITLE: BOGIE SYSTEM

SCALE: 1:25 | APPROVED | DATE (RO ISSUE) 17-07-2018

DEL.CENTRE-DISC/MUM-ME | S4/-ATN | DATE (ERROR FREE) 17-07-2018

DRN: ASP | S4/-SBN | S4/-RS

CHD: S4/-ABD | DWG NO TCE.10977A-ME-859-GA-0010(SH1OF2) | ISSUE RO

FOR RO ISSUE ONLY

CLEARED		
DEPT	SIGNATURE	DATE
CHEM		
CIVIL		
ELEC		
I&C		
MECH		

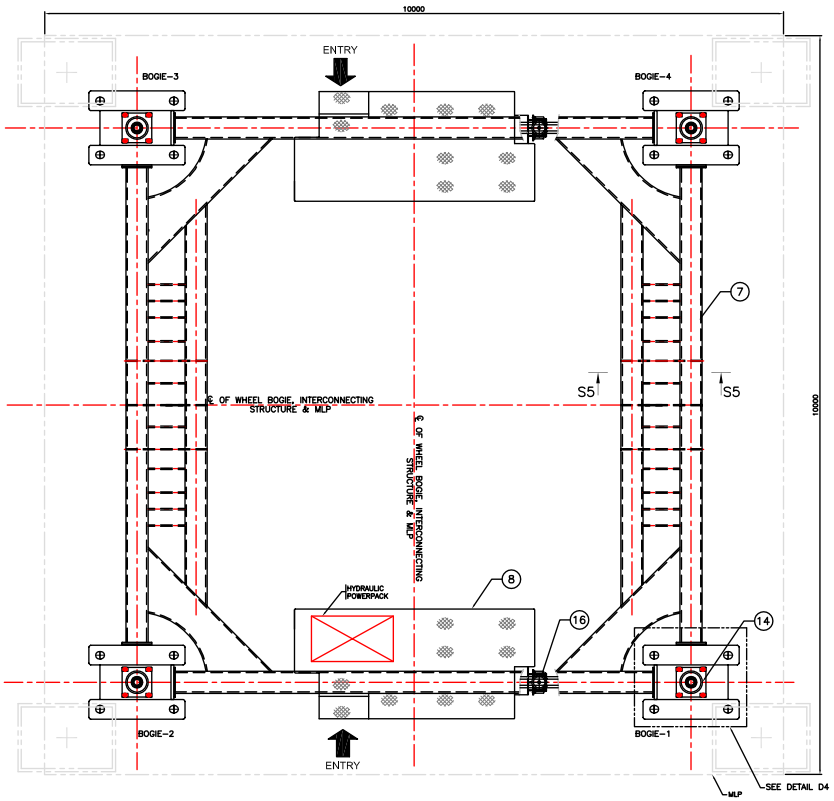
FILE NAME: F-041-Rev-R0.dwg

ISSUE	REVISIONS	DRN	CLEARED					APPD	DATE
			CHEM	CIVIL	ELEC	I&C	MECH		
RO	FOR TENDER PURPOSE	ASP	–	–	–	–	RS	ATN	17-07-18

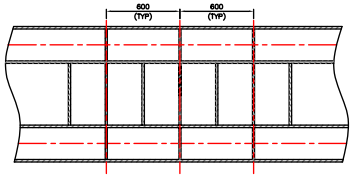
TCE FORM NO. 041 R0

TITLE: BOGIE CONCEPT

DWG NO: TCE.10977A-ME-859-GA-0010(SH20F2)



PLAN
(BOGIE SHOWN WITHOUT BALANCERS AND WHEELS)



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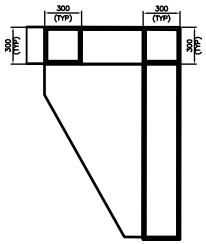

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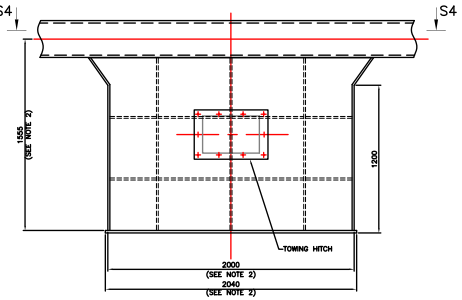
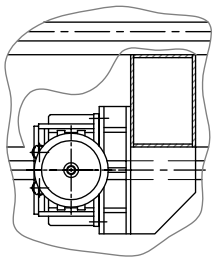
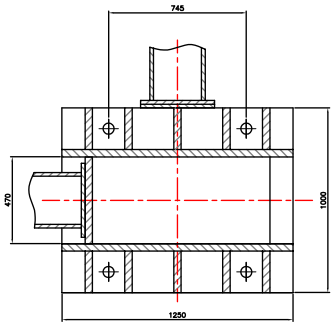


DETAIL D4
(SCALE 1:15)



VIEW V5
(SCALE 1:20)



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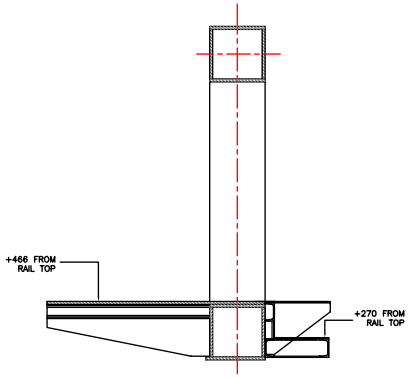

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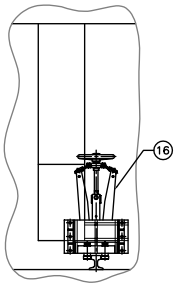

VIEW V4
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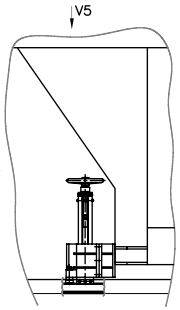

DETAIL D3
(SCALE 1:20)
(PLATFORMS IS NOT SHOWN FOR CLARITY)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE HAULER INTERFACE ARRANGEMENT SHOWN IN DETAIL D3 OF THIS DRAWING IS TENTATIVE. IT SHALL BE MODIFIED BY THE VENDOR AS PER THE PURCHASER'S INSTRUCTIONS AFTER THE AWARD OF CONTRACT.

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CHEM			RO	FOR TENDER PURPOSE	ASP	–	–	–	–	RS	ATN	17-07-18
CIVIL												
ELEC												
I&C												
MECH												

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